SB
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R38
Vol. 17
1929
Science

Afdeeling Phytopathologie
Rijks-Univ. Utrecht
te BAARN.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

12 JUNE 70

VOL. XVII.
(1929.)

ISSUED BY THE IMPERIAL
INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, LONDON, S.W.7.
1930.

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ERRATA.

Page 44 line 43 for " Argentina " read " British Guiana "
,, 44 ,, 44 ,, " *Parasierola* " read " *Perisierola* "
,, 64 lines 25 and 27 and 65 line 26 for " *rugostriatus* " read " *rugosostriatus* "
,, 73 line 11 for " *Pseudoaphycus* " read " *Pseudaphycus* "
,, 89 ,, 13 for " Knig " read " King "
,, 90 ,, 30 ,, " J. B. Spittall " read " J. P. Spittall "
,, 106 ,, 8 ,, " *echinodacti* " read " *echinocacti* "
,, 107 ,, 1 ,, " *migratoroides* " read " *migratorioides* "
,, 114 lines 3, 21 and 38 for " *Parasierola* " read *Perisierola* "
,, 127 line 44 after " Dr. W. Horn." insert " 1928 "
,, 154 lines 12 and 13 for " *tiracholae* " and " *Tirachola* " read " *tiracolae* " and " *Tiracola* "
,, 172 line 44 for " *Anaplocnemis* " read " *Anoplocnemis* "
,, 187 ,, 31 after " carried out " insert " at the end of the growing season but "
,, 208 ,, 21 for " *Nemoriella* " read " *Nemorilla* "
,, 216 ,, 5 ,, " Forester " read " Foerster "
,, 219 ,, 25 ,, " 219 " read " 216 "
,, 235 ,, 12 ,, " *Anagalis* " read "*Anagallis* "
,, 253 ,, 38 ,, " *Anthemyia* " read " *Anthomyia* "
,, 266 lines 33 and 39 for " *Perissodores* " read " *Perissoderes* "
,, 267 line 19 for " *candezoi* " read " *candezei* "
,, 276 ,, 17 ,, " *P. silvestris*, and *P.*" read " *P. sylvestris*, and *Picea* "
,, 290 ,, 22 ,, " *Erithrina* " read " *Erythrina* "
,, 290 ,, 45 ,, " *nonagroides* " read " *nonagrioides* "
,, 320 ,, 16 ,, " *Campanotus* " read " *Camponotus* "
,, 320 ,, 19 ,, " *Ichnaspis* " read " *Ischnaspis* "
,, 344 ,, 41 ,, " *Melanoxanthelium* " read " *Melanoxantherium* "
,, 365 ,, 19 ,, " New Brunswick, N.J." read "[Springfield, N.J.] "
,, 365 ,, 28 ,, " no. 61 " read " no. 66 "
,, 389 ,, 3 ,, " Walsh " read " Cress."
,, 403 lines 27, 28, 32, 40 and 43 for " *aenovirens* " read " *aeneovirens* "
,, 476 line 35 for " *atricornis*, F." read " *atricornis*, Mg."
,, 488 ,, 17 ,, " south-western " read " south-eastern "
,, 489 ,, 34 ,, " Ext (—)." read " Hellmann (—)."
,, 499 ,, 5 ,, " *Gasteropacha* " read " *Gastropacha* "
,, 563 ,, 6 ,, " *Rhopalosiphun* " read " *Rhopalosiphum* "
,, 571 ,, 37 ,, " *Paratetranchus* " read " *Paratetranychus* "
,, 578 lines 12 and 13 for " *robinarium* " read " *robiniarum* "
,, 607 line 35 for " *Pomphopaea* " read " *Pomphopoea* "
,, 619 ,, 45 ,, " Headlee (T. P.) " read " Headlee (T. J.) "
,, 657 1 line from end for " *Marasmius* " read " *Marasmia* "
,, 675 line 35 for " *Tryphaena* " read " *Triphaena* "
,, 677 line 36 for " *Pteronus* (*Nematus*) *pini*, L." read " *Pteronus* (*Nematus*) *ribesii*, Scop. (gooseberry sawfly), *Diprion* (*Lophyrus*) *pini*, L."
,, 701 ,, 47 ,, " *cornatus* " read " *cornutus* "
,, 733 ,, 39 ,, " *Ecthromorpha* " read " *Echthromorpha* "

IMPERIAL BUREAU OF ENTOMOLOGY.

REVIEW
OF
APPLIED ENTOMOLOGY.

SERIES A.

VOL. XVII.] [1929.

EDITORIAL.

With the issue of a new volume of the *Review of Applied Entomology*, an opportunity arises to call the attention of readers to some changes in policy that have been made during the past year.

Owing to the great increase in quantity and complexity of the world's literature on Economic Entomology, it has been found necessary to restrict the potential growth of the monthly parts of the *Review*, if their contents are to be kept up to date, and it is obviously of the first importance that this should be so. It has, therefore, become advisable to notice certain classes of papers by titles only instead of issuing abstracts of them. At present these mainly comprise two classes: (1) systematic papers dealing with groups of insects that are potentially of economic importance; and (2) papers the contents of which have already been noticed in the *Review* in another form. This treatment of systematic papers on such groups of insects as, for example, Aphids, Coccids and mosquitos, is felt to be justified in view of the fact that these are already dealt with in detail in the *Insecta* part of the *Zoological Record*, which is prepared and published annually by the Bureau.

It has also been decided to exclude papers dealing with Nematodes, as these do not properly come within the scope of the *Review*.

[POLYAKOV (V. Ya.).] **Поляков (В. Я.). The Large Larch Sawfly (*Nematus erichsonii*, Hrt.).** [*In Russian.*]—*Trud. sib. Inst. Sel. Khoz. Lesovod.*, ix, no. 1–5, pp. 199–215, 2 figs., 9 charts, 4 refs. Omsk, 1928.

Lygaeonematus (*Nematus*) *erichsoni*, Htg., all stages of which are described, is one of the chief pests of larch in western Siberia, retarding the growth of the trees, as well as rendering them liable to the attacks of other pests. As no measures were taken against it from 1918 to 1921, the damage done was particularly severe. Studies were made in 1924 near Omsk in a forest consisting mainly of birch and aspen, in which pines and larches were planted. The sawflies were on the wing in the second half of June. Oviposition began 2–4 days after the emergence of the adults, and the eggs were laid in the bark of one-year-old shoots on the unshaded part of the crown. The mass oviposition

occurred between the 22nd and 26th of June, from 13 to 50 eggs being laid in each shoot. The egg stage lasted 8–10 days, and the active larval stage about 24. The larvae feed on the needles and hibernate under the forest-trash or in the upper layer of the soil in cocoons ; the first cocoons were found at the beginning of August. Pupation occurs about 10th June in the following year, and the adults emerge 8 or 10 days later. Most of the cocoons occur near the trunk of the tree, only single individuals being found beyond the radius of the crown. The females may live as long as two weeks and usually reproduce parthenogenetically. In Canada and European Russia, *L. erichsoni* completes its life-cycle in a year, but in western Siberia 50 per cent. of the larvae remained in their cocoons for a second winter.

The natural enemies of *L. erichsoni* include insectivorous mammals and birds. Two Ichneumonids parasitise the cocoons, about 14 per cent. being infested, while 18 per cent. are killed by a fungus. Shrubs planted between the trees help to form a thick and damp layer of forest-trash, which favours the development of the fungus. Insectivorous birds should be attracted by means of artificial nests. Other remedial measures include hand-picking the larvae, and the application of adhesive bands after shaking the trees. Good results were obtained by spraying with 1 oz. Paris green, 6 oz. freshly slaked lime and a pint of thin flour paste in 6 gals. water.

The larvae of *L. wesmaeli*, Tischb., were found hibernating in cocoons in the soil under the damaged larches, and larvae of this and another sawfly were also observed damaging larch at the same time as *L. erichsoni*.

[Uvarov (B. P.).] **Уваров (Б. П.). The Present State of the Locust Question in various Countries.** [*In Russian.*]—*Khlopkovoe Delo*, vii, no. 7–8, pp. 559–572, 15 refs. Moscow, 1928.

The literature on recent outbreaks of locusts in various countries is reviewed, and the organisation against them adopted in each is discussed. In general locusts of several species have tended to increase during the last few years, and the need for extensive studies of the locust problem on an international scale is urged.

Uvarov (B. P.). **Locusts and Grasshoppers. A Handbook for their Study and Control.**—Imp. 8vo, xiii + 352 pp., 9 pls., 1 map, 118 figs. London, Imperial Bureau of Entomology, 1928. Price 21*s*.

In this very full work on the subject an attempt has been made to collate all available information on the locust problem, its aim being to present a general survey of the accumulated knowledge on Acridids, their bionomics and the theory and practice of their control. Special stress is laid throughout the book on one particular aspect of the problem, *viz.*, the great importance in the life of the insects and in their economic relations with man of the actual conditions of their environment in the broadest sense of the word. The whole problem of control is dealt with at great length, emphasis being laid on the value of the poison bait methods as compared with others that have found favour in the past.

Incidentally, the author defines the terms " locust " and " grasshopper," the former being used to denote only such species as definitely

possess gregarious habits and wander or migrate in swarms, while the latter is used for non-gregarious and non-migrating species. The general part of the volume is taken largely from the author's book published in Russian in 1927 [*R.A.E.*, A, xv, 618] with the addition of much further data, particularly on natural enemies, but Chapters x to xix have been written especially for the English edition.

In a final chapter the author summarises his conclusions and indicates the lines on which future research should be based.

A bibliography of some 400 titles and a comprehensive index are included.

[Rekach (V. N.).] **Рекач (В. Н.). Results of a Study of** *Chloridea obsoleta*, **F., and its Control in Gandzha.** [*In Russian.*]—*Khlopkovoe Delo*, vii, no. 7–8, pp. 544–559, 1 fig., 3 refs. Moscow, 1928. (With a Summary in English.)

Heliothis (*Chloridea*) *obsoleta*, F., causes great damage to cotton in Azerbaijan. A special study of this moth was made in 1927, when four generations were recorded, though the number varies according to local temperature conditions. *H. obsoleta* hibernates only in the pupal stage. The spring flight of the moths occurs in the first half of May, and they sometimes cover large distances in search of food. The second generation is the most numerous one, and it is on the wing from the middle of June till the middle of July. The hardening of the soil as a result of periodical waterings during extremely hot weather prevents the adults from emerging; this, as well as the strong winds, which lasted from the end of July till the end of August and interfered with feeding and oviposition, accounts for the decrease in the numbers of the third and fourth generations. Development is retarded when the spring is cold and wet. The fall of the soil temperature below 15° C. [59° F.] in the autumn stops the emergence of the moths and kills the larvae that have not entered the soil. Shortage of moisture in the soil also affects the emergence of the adults. The most favourable temperature for the development of the pupae is 28° C. [82·4° F.]; at 50° C. [122° F.] the adults do not emerge, and at 65° C. [149° F.] the pupae die. Oviposition begins two days after the emergence of the moths and lasts from 9 to 12 days. The largest number of eggs laid by one moth was 700. The egg-stage lasts 2–3 days (in the autumn up to 2 weeks), the larval stage 13–19 days and the pupal 11–13. The adults do not live longer than 2 weeks.

H. obsoleta is a general feeder before it migrates to cotton, and over 100 food-plants of the larvae have been recorded. The larvae of the first generation feed on weeds and leguminous plants, those of the second chiefly on maize, and those of the third chiefly on cotton. Eggs are laid anywhere, but for preference on the weeds round a cotton field. During the flowering of cotton in August, which occurs at the time of the appearance of the third generation, the moths migrate to the cotton, and the larvae occur there till the cold weather.

Maize planted simultaneously with cotton in late April or early May did not prove an effective trap-crop, and experiments showed that *Cicer arietinum* and *Sorghum cernuum* are the best trap-plants. *C. arietinum* was sown three times: on the 16th and 28th of April and on the 3rd of June. The larvae of the first and second generations were concentrated on the first two sowings in May; the third sowing attracted the moths of all subsequent generations, the larvae remaining

on it until late in November. Larvae were most numerous on *Sorghum* during August and September, when they are abundant on cotton. *Cajanus indicus* proved to be an excellent trap-plant, especially after the middle of August, but under local conditions its cultivation was impossible. Dusting with calcium arsenate or with Paris green, at the rate of about 14 lb. to the acre, killed all the larvae. Liquid insecticides and ploughing were less effective.

[Dekhtyarev (N. S.).] **Дехтярев (Н. С.). Injurious Insects in the Ukraine in 1926-1927.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 14–25. Kharkov, 1928.

This is a list of injurious insects recorded in the Ukraine during 1926–27, showing their local distribution and food-plants where known.

[Migulin (A. A.).] **Мигулін (О. О.). Observations on Vineyards in the Ukraine to determine the Spread of** *Phylloxera* **in 1927.** [*In Ukrainian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 33–48, 1 map, 4 refs. Kharkov, 1928.

The distribution of *Phylloxera* in the Ukraine and the history of previous infestations are reviewed. Though some fresh infestations were discovered in 1927, the pest had disappeared in certain vineyards.

[Selezn'ev (N. G.).] **Селезньов (М. Ю.). The Results of Research Work on Pests and Diseases of the Sunflower in the Ukraine in 1927.** [*In Ukrainian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 48–51. Kharkov, 1928.

The chief insect pests of sunflowers recorded in the Ukraine during 1927 were *Homoeosoma nebulella,* Hb., *Agapanthia dahli,* Richt., and *Mordellistena parvula,* Gyll.

[Vernigor (S. F.).] **Вернигор (С. Ф.). On the Biology of** *Poeciloscytus cognatus,* **Fieb.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 97–105, 8 figs., 16 refs. Kharkov, 1928.

The literature on *Poeciloscytus cognatus,* Fieb., is briefly reviewed, with a detailed description of all stages of this Capsid and a key to the various instars. The adults appeared in 1926 near Poltava on lucerne, but in the middle of June large numbers of them attacked beet. By this time the females began to lay eggs, the number laid by one female varying from 25 to 48. The eggs hatched in 14–16 days, complete development from egg to adult requiring 45 days. Adults were most numerous in the middle of June and the beginning of August. During the latter month the females laid eggs that hibernated on weeds and lucerne. In the Ukraine *P. cognatus* has two generations during the summer. It is a general feeder, but prefers beet.

A small Trombidiid, the Proctotrupid, *Eurythmelus goochi,* Enock, and the bug, *Nabis* (*Reduviolus*) *ferus,* L., are the most important natural enemies of *P. cognatus.*

Three other Capsids occur in small numbers on beet, *viz.*, *Poeciloscytus vulneratus,* Panz., *Orthotylus flavosparsus,* Sahlb., and *Lygus pratensis,* L., the latter being a general feeder. It hibernates in the

adult stage and appears in early spring, having three generations a year. Contact sprays proved of little value against the full-grown nymphs and adults of *P. cognatus*, but kerosene emulsion was comparatively effective against the young nymphs. As, however, the hatching of the eggs extends over a considerable period, spraying would have to be repeated several times. Weeds round the beet fields, on which *P. cognatus* develops and lays hibernating eggs, should be destroyed.

[Strel'tzov (I.).] **Стрельцов (И.). Experimental Control of *Tropinota hirta*, Poda, by attracting the Beetles to blue sticky Sheets of Paper.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 106–111, 2 figs., 4 refs. Kharkov, 1928.

Epicometis (*Tropinota*) *hirta*, Poda, is one of the most important orchard pests in the Ukraine and in the whole of south-eastern Russia. The control of the beetles by attracting them to blue sticky paper varied in efficacy in different places and at various periods. A detailed description of the application of this measure in 1927 is given. The beetles appeared on 21st April, and about a week later began to gather in great numbers in orchards. They were obviously more attracted to blue paper than to violet, while sheets covered with an opaque sticky material proved to be repellent owing to the odour of the glue. White, red and green sheets attracted the beetles very little. The best time for catching them was before 9.30 a.m. Smaller numbers are caught when the weather is cloudy and windy. The sheets of paper have to be renewed often, as they fade and cease to attract the beetles. Sheets covered with glue are considerably more attractive than clean ones, as the beetles are attracted not only by the colour of the paper, but also by the individuals already stuck to it. This measure is a very cheap one, but is only worth while when great numbers of beetles attack the trees.

[Krasnyuk (P.).] **Краснюк (П.). *Tychius quinquepunctatus*, L., as a Pest of Beans and Peas in 1927.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 123–126, 9 figs. Kharkov, 1928.

Tychius quinquepunctatus, L., occurred in great numbers on beans in the Ukraine in May, causing 30 per cent. of the plants to wither. The weevils feed on the top of the plant first and then on the petioles of the leaves. The eggs are laid through the seed pod on to the seed; this and other habits of the insect are described. No eggs were discovered on beans, which only serve as food for the adults, but they were found on peas between 4th and 10th July. Under laboratory conditions, the larvae hatched within 5–7 days, and in about three hours, penetrated into the peas. They pupate in the soil at a depth of about an inch. The weevils began to emerge on the 10th of August. In the field the weevils did not appear on the soil surface during the autumn, which indicates that the adults hibernate in the pupal chamber. Between 1st and 10th July they almost entirely disappeared from the beans and migrated to adjoining peas, where they damaged 15 per cent. of the crop. After the peas were harvested, the beetles returned to the beans, where they remained till 10th August. In 1928 the chief damage was done to beans in the neighbourhood of large plantations of peas, while in a field at a distance of about half a mile the weevils were almost entirely absent.

[Kazas (I. A.).] **Казас (И. А.). The Fumigation of Vine Slips with Hydrocyanic Acid Gas.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 126–131, 6 refs. Kharkov, 1928.

The history of the fumigation of vine roots with hydrocyanic acid gas against *Phylloxera* and the literature on the subject are very briefly reviewed. The technique of experiments carried out in Odessa in 1927 with roots infested with hibernating *Phylloxera* is fully described. An exposure of 30 minutes to a dosage of 1 oz. of sodium cyanide, 2 oz. of sulphuric acid and 4 oz. of water to every 100 cu. ft. killed all the Aphids, provided that the roots were free from damp earth and wet packing. Packing does not interfere with the action of the fumigant if dry, but where damp earth and packing closely covered the roots, the Aphids were not killed. An increase in the dosage or duration of fumigation did not give better results. Hydrocyanic acid gas does not affect the growth of the plants.

[Puzuirnuiĭ (R. G.).] **Пузырный (Р. Г.). The Control of** *Euxoa segetum,* **Schiff., by trapping the Moths with Molasses Baits.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 132–138, 1 ref. Kharkov, 1928.

Extensive experiments were made in the Ukraine in 1926 with traps of molasses to determine the number of pans necessary to the acre to reduce the numbers of *Euxoa segetum,* Schiff., to a negligible quantity. A detailed account is given of the methods used and the number of insects caught. Approximately 3 pans to an acre were sufficient, each acting within a radius of 66 ft. Further experiments showed that moths from adjoining fields were not attracted by the baits, but that the larvae on the treated plots were fewer than on the neighbouring fields.

[Kamuishnuiĭ (N. S.).] **Камышный (Н. С.). A Study of the Damage done by** *Anthonomus pomorum,* **L.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 138–147, 1 fig., 3 diagrs., 2 refs. Kharkov, 1928.

This is a preliminary report on a study of the inflorescences of apples and pears in the Kharkov Government and their relation to the ultimate crop. *Anthonomus pomorum,* L., mainly attacks healthy and fertile blossoms ; barren blossoms fall long before the larvae are full-grown, while healthy flowers, although injured by the weevil, remain on the trees throughout the whole period of the pupal stage, thus forming very suitable conditions for its development. In 1927, the pistils of about 5 per cent. of the infested blossoms were apparently fertile, only the stamens being injured. It is suggested that the best means of controlling this weevil is by improved cultural methods, which will result in an increase of fruit buds and in a greater resistance of the blossoms to injury.

[Vasil'ev (I. V.).] **Васильев (И. В.).** *Agrilus viridis,* **L., var.** *fagi,* **Ratz., as Pest of Bush Fruits in the Ukraine.** [*In Russian.*]—*Prot. Pl. Ukraine,* iii–iv, pp. 147–149, 1 fig., 3 refs. Kharkov, 1928.

The literature relating to *Agrilus viridis,* L., var. *fagi,* Ratz., is very briefly reviewed ; it attacks various forest trees as well as vines and

roses. Observations made in the Kharkov Government from 1922 to 1925 showed that this Buprestid caused considerable damage to currant and gooseberry bushes. In the Ukraine it has only one generation a year, and it hibernates as a larva. Pupation occurred early in May, and the pupal stage lasted nearly three weeks. The adults appeared at the end of May, and their mass flight lasted from the beginning of June till 24th July. Oviposition occurs in June, the eggs being laid chiefly on last year's shoots. Not more than 2–4 eggs were laid at a time, the total number reaching about 30. They hatch in about two weeks, the larvae appearing at the end of June and beginning of July. They feed on the leaves, attacking chiefly two-year-old growth, which usually withers in the same year. In some cases as many as 50 per cent. of the shoots were infested, thus affecting the ultimate crop of fruit. A Chalcid parasite attacks the larvae. It hibernates in the larval stage and appears at the beginning of May, having at least two generations a year. In 1922 this parasite infested 25 per cent. of the host, the numbers of which, however, did not decrease in the next year. The larvae of *Malachius geniculatus*, Germ., are predacious on those of *A. viridis*.

The best and simplest remedial measure is to cut all the dying and dead branches in the second half of April before the beginning of the flight of the beetles. Should this not have been done, spraying with an arsenical, such as Paris green at the usual strength (1 oz. to 3 oz. unslaked lime and 6 gals. water), is recommended.

[Grossgeĭm (N. A.).] **Гроссгейм (Н. А.). Shaking as a Method of ascertaining the Number of Weevils on Fruit Trees and Examples of its Application.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 149–155, 6 figs. Kkarkov, 1928.

The value of shaking weevils from the trees in order to obtain biological data is pointed out. During experiments made in the Ukraine in 1926 and 1927, the species recorded from apple trees were *Anthonomus pomorum*, L., *Rhynchites pauxillus*, Germ., *Sciaphobus squalidus*, Gyll., and *Rhynchites bacchus*, L. This work is best done on fully grown trees (20–30 years old), and should be carried out on batches of ten trees at intervals of five days beginning at a fixed phenological date.

The author discusses the value of lime-washing and adhesive bands. In 1927 there was no difference in the development of sprayed or unsprayed trees, though it has been claimed that a lime spray retards the bursting of the buds, which is considered an advantage when early morning frosts are likely to occur. The application of milk of lime alone or mixed with clay is a very troublesome operation, requiring a great quantity of the spray, and, moreover, it does not act as a repellent. Adhesive bands decreased the number of the weevils by 50 per cent. in the case of the species that fly and by 95 per cent. in the case of *S. squalidus*.

[Pyatakova (V. L.).]. **Пятакова (В. Л.). Records of the Winter Population of Fruit Trees.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 155–158. Kharkov, 1928.

The importance of predicting the infestation of fruit trees by insect pests in order to make the best use of remedial measures is pointed out. This may be done by calculating the number of insects found in the

winter on one- and two-year-old shoots. These figures, correlated with the total length of shoots, will give the approximate number of insects on the tree. The results of the application of this method during the winter 1926–27 in the Ukraine are described.

[Deryabin (N. P.).] **Дерябин (Н. П.). Notes on Tortricids attacking Fruit Trees in the Mariupol District.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 158–161. Kharkov, 1928.

In this district of the Ukraine *Tortrix rosana*, L., all stages of which are described, is one of the chief pests of fruit trees, roses and other ornamental bushes. Field and laboratory observations on it were carried out in 1926–27. The eggs are usually laid in June in batches on smooth places of the bark of thick branches, where they pass the winter. The larvae hatch next spring, on apricot during the flowering period and on apple and pear when the flower-buds burst, and penetrate at once into the centre of unopened leaves and flowers. By the end of May and beginning of June they pupate, the mass flight of the adults occurring in the middle of June. In 1926 no parasites were observed, but in 1927 one parasite of the larvae and five of the pupae were found. Spraying with iron sulphate was not effective. A mixture of lime and waterglass (50 per cent. sodium silicate) was used at the rate of 6 lb. lime to 6 gals. water. After straining the mixture 1 lb. silicate was added. Spraying the eggs with this mixture just before they hatched reduced the number of the larvae. Successful results were obtained with molasses baits for the adults ; the baits should be exposed before the beginning of the flight of the moths, as oviposition occurs two or three days later.

The grape Tortricid, *Clysia ambiguella*, Hb., was found exclusively on a local variety of grape.

[Klokov (E. V.).] **Клоков (Е. В.). Notes on a Beetle injuring the Seeds of Sainfoin** (*Onobrychis sativa*). [*In Russian.*] –*Prot. Pl. Ukraine*, iii–iv, pp. 161–164, 5 figs., 4 refs. Kharkov, 1928.

Considerable damage was done in the Ukraine in 1926 to the seeds of sainfoin (*Onobrychis sativa*) by the larvae of *Bruchidius unicolor*, Oliv. (*olivaceus*, Germ.), all stages of which are described. Field and laboratory observations were therefore carried out in 1927. The beetles appeared in the second half of June at the period of flowering of the sainfoin, and their flight lasted about two months. Eggs are laid on the green pods, and the larvae feed exclusively on the seeds, penetrating into them and remaining there for hibernation and pupation. In seeds kept in granaries pupation did not occur till late spring, but under laboratory conditions at a temperature of 15–18° C. [59–64·4° F.], the adults emerged in February. During the August flowering period sainfoin is not affected by this Bruchid. About 60 per cent. of the larvae are attacked by a mite ; they are also parasitised by two unidentified Hymenoptera.

[Novinenko (A. I.).] **Новиненко (А. И.). Insects as Carriers of Mosaic Disease of Sugar-beet. (Preliminary Note.)** [*In Russian.*]—*Prot. Pl. Ukraine*, iii–iv, pp. 164–168, 3 figs. Kharkov, 1928.

In 1927 experiments were made in the Kharkov Government to determine the relation of insects to mosaic disease of sugar-beet.

Insects were collected from leaves infected with the disease in the field and caged on healthy plants in the laboratory. On 10th October, which was the time of the beet harvest, 100 per cent. of the experimental plants had been infected with mosaic disease by *Aphis fabae*, Scop., 40 per cent. by *Poeciloscytus cognatus*, Fieb., and 20 per cent. by each of three Jassids (*Euscelis striatulus*, Fall., *Cicadula sexnotata*, Fall., and *Empoasca* (*Chlorita*) *flavescens*, F.). Early symptoms appeared on a great number of other plants, but the disease disappeared again; thus *Orthotylus flavosparsus*, Sahlb., infected 60 per cent. of the plants, all of which recovered by 10th October. Other insects under experiment did not produce the disease. Quite a long period passes between the infestation of the plants with insects and the first symptoms of the disease. In the field the insects chiefly attack the young plants, especially during the blooming period. These are, therefore, a reservoir of the disease. Although under laboratory conditions it may seem that *Aphis fabae* is the chief carrier, field observations showed that the Capsids and Jassids caused most of the infection owing to their activity and greater numbers.

[Kolosov (Yu. M.).] **Колосов (Ю. М.). Insects of Central Ural attacking Raspberries.** [*In Russian.*]—*Sib. Plodov. Ogorodn.*, no. 3 [proof, 2 pp.], 1 fig. Omsk, 1928.

This is a short and popular account of investigations made near Sverdlovsk in the spring 1928 on the insects attacking raspberries. The most important pest is an Anthomyiid fly, which lays its eggs in the young shoots of the current year. The larvae develop inside the stem, thus causing the shoots to wither. It may be controlled by cutting off the infested shoots 7–9 inches lower than the withered spot. The larvae of *Pennisetia* (*Bembecia*) *hylaeiformis*, Lasp., occurred in raspberry stems. *Byctiscus* (*Rhynchites*) *populi*, L., was found breeding on raspberry leaves, although hitherto it had only been known to infest the leaves of poplars and aspens. Hand-picking the infested leaves is recommended, as well as shaking off the weevils every 3 or 4 days. *Otiorrhynchus ovatus*, L., and the Noctuid, *Scoliopteryx libatrix*, L., sometimes feed on the raspberry fruit. Although *Byturus tomentosus*, F., is one of the most serious raspberry pests in central Russia, it is not of economic importance in the Ural. In Sverdlovsk it occurs in the spring on the leaves and blossoms.

[Fedorov (S.).] **Федоров (С.). Observations on *Phylloxera* in Vineyards of the South Coast of the Crimea in 1927-28.** [*In Russian.*]—*Vest. Vinodel. Ukrainui*, xxix, no. 11, pp. 670–673. Odessa, 1928.

The organisation of a survey of the occurrence of *Phylloxera* on the south coast of the Crimea during 1927–28 is described. No definite statistics can yet be given, but the general condition of the vineyards as regards infestation appears satisfactory. The importance of establishing disinfection chambers in various localities and of adopting quarantine measures is pointed out.

Mordvilko (A.). **Les Pemphigiens des pistachiers et leurs formes anolocycliques.**—*Bull. Soc. zool. Fr.*, liii, pp. 358–366, 7 refs. Paris, 1928.

This is an additional note to a paper already noticed [*R.A.E.*, A, xvi, 52]. The Pemphigines peculiar to each individual species of *Pistacia* are enumerated, and the distribution of the anholocyclic forms is discussed. *Pemphigetum muticae*, gen. et sp. n., is recorded on *Pistacia mutica*. *Forda hirsutum*, sp. n., was found in the lateral folds of the leaves of *Pistacia vera* in Turkestan.

Escherich (K.). **Der heutige Stand der Arsenbekämpfung der Forstschädlinge mittels Flugzeug.** [The present Condition of the Use of Arsenicals against Forest Pests by Means of Aeroplanes.]—*Forstwiss. Centralbl.*, l, pp. 421–436. Berlin, 1928.

The development of the use of aeroplanes for applying arsenical dusts against forest pests in various parts of the world is reviewed, and brief particulars are given of the occasions on which this method has been employed in Germany. Its value is indisputable, though various insects, and also the different stages of a given species, react differently to arsenic. The best results have been obtained against *Lymantria* (*Liparis*) *monacha*, and the worst against the May beetles [*Melolontha melolontha*]. The Görnitz method of determining the adhesiveness of dusts [*R.A.E.*, A, xv, 646] is in general use, but is not quite accurate, on account of the difference between the surface of the plate and the surface of leaves. The physical structure of the dust and the nature of the distributor carried by the aeroplane affect the distribution of the insecticide on the trees. In Germany the average cost of dusting from the air seems to be about 24 shillings an acre.

Eidmann (H.) & Berwig (W.). **Untersuchungen über physikalische Eigenschaften, insbesondere die Haftfähigkeit, von Arsenbestäubungsmitteln.** [Investigations on the physical Properties, especially Adhesiveness, of arsenical Dust Insecticides.]—*Forstwiss. Centralbl.*, l, pp. 529–542, 575–586, 10 figs., 13 refs. Berlin, 1928.

Among the properties required in dust insecticides for application from aeroplanes against forest pests are toxicity to insects at low strengths (in some cases a dust containing 6–11 per cent. of arsenic is as effective as one containing 40 per cent.), great adhesive power, resistance to rain, fineness of particles, and non-separability of the components. Experiments on adhesive qualities and resistance to rain with 7 proprietary insecticides, French chalk and ground sulphur, followed by feeding tests on Lepidopterous larvae, are described in detail. The effect of wind is very different from that of jarring and should be tested separately [an electric fan was used]. Resistance to rain is usually a quality distinct from adhesiveness. The fine and uniform distribution of a dust and the possibility of the components being separated as a result of wind, rain or jarring are of the highest importance ; chemical analysis of the material left adhering is essential for exact information on the latter point. Actual tests with the particular pest concerned must always be made, regard being paid to such points as the imminence of moulting or pupation.

Blunck (—). **Drohendes Massenauftreten eines Schädlings der Kohl- und Steckrübenkulturen.** [A threatening Outbreak of a Pest of Cabbage and Turnip.]—*Landw. Wbl. Schles.-Holst.*, no. 22, reprint 1 p. Kiel, 1st June 1928.

The cabbage moth, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) was exceptionally abundant in the spring of 1928 in Schleswig-Holstein. The caterpillars of the first generation, occurring in June, are very harmful to turnips, while those of the second, generally considered the more injurious, infest cabbage. As the plants suffer more when young, it is advisable to sow early, plant out vigorous seedlings, and hoe the ground frequently. By drawing a cord across the plants or by tying twigs to the hoe, as practised in Denmark, the caterpillars will be shaken to the ground and buried during hoeing. The plants should not be thinned when infestation is at its height, because the caterpillars on the uprooted plants will infest those left standing, unless the former are destroyed immediately.

[Printz (Ya. I.).] Prinz (J.). **Die Schmierlaus (*Pseudococcus citri*, R.) am Rebstock in Transkaukasien.** [The Mealy-bug, *P. citri*, on the Grape-vine in Transcaucasia.]—*Anz. Schädlingsk.*, iv, no. 9, pp. 119–124. Berlin, 15th September 1928.

This paper is a translation of a section on *Pseudococcus citri*, Risso, in a report on vine pests in Transcaucasia already noticed [*R.A.E.*, A, xvi, 607].

Dingler (M.). **Merkwürdiges Auftreten einiger Hausschädlinge.** [Remarkable Occurrences of some Household Pests.]—*Anz. Schädlingsk.*, iv, no. 9, pp. 124–125, 3 figs. Berlin, 15th September 1928.

The clothes moth, *Tineola biselliella*, Hum., is recorded as infesting sugar.

Nechleba (A.). **Vorläufiger Bericht über die letzte ostkarpathische Borkenkäferinvasion.** [Preliminary Report on the last Bark-beetle Outbreak in the East Carpathians.]—*Anz. Schädlingsk.*, iv, no. 9, pp. 125–126. Berlin, 15th September 1928.

Some notes are given on the bark-beetle outbreak that began in the East Carpathians in 1916–17 and reached its maximum in 1920–21 at altitudes of about 2,000 to 4,000 ft. Pre-disposing factors were the destruction due to military operations, injury by wind, and the neglect of all forest measures. The infestation was one of the most serious in Central Europe. Preventive measures in 1921 consisted of the clearing of infested timber and the preparation of trap-logs.

Sajewycz records that *Ips typographus*, L., had a normal first generation accompanied by a parallel generation that, owing to lack of vitality in the mother beetles, was weak and scanty and sometimes failed to develop. A similar record for *Myelophilus piniperda*, L., has been noticed [*R.A.E.*, A, xvi, 4, 658].

Koch (R.). **Bestimmungstabellen der Insekten an Fichte und Tanne nach den Frassbeschädigungen.** [Keys to the Insects of Spruce and Silver-fir according to the Injury caused by Feeding.]—2nd edn., xx+145 pp., 210 figs. Berlin, Paul Parey, 1928. Price *M.* 6.50.

In these keys to insects attacking spruce and fir [*Abies*] in Germany, the insects concerned and the damage they do are described and also illustrated in many cases.

Pogge (—). *Eccoptogaster intricatus* **Ratzbg. als Eichen-Waldgärtner.** [*Scolytus intricatus* attacking the Tips of Branches of Oak.]—*Z. Forst- u. Jagdw.*, lix, p. 564. Berlin, 1927. (Abstract in *Z. Pfl Krankh.*, xxxviii, no. 9–10, p. 308. Stuttgart, 1928.)

A case is recorded in which *Scolytus* (*Eccoptogaster*) *intricatus*, Ratz., migrated from infested park benches made of newly-felled, barked oak poles to 35-year-old oaks, under which many fallen twigs were found later. These had been gnawed about 4 inches from the tip, and were then broken off by wind and rain.

Bongini (V.). **Ancora sul** *Brachycerus algirus*, **L.** [Further Notes on *B. algirus*.]—*Curiamo le Piante*, iv, p. 54. Alba, 1927. (Abstract in *Z. Pfl Krankh.*, xxxviii, no. 9–10, p. 309. Stuttgart, 1928.)

The Curculionid, *Brachycerus algirus*, L., is recorded as very injurious in the garlic plantations in Tuscany in 1926.

v. Lingelsheim (A.). **Ein neuer Schädling des Wurmfarnes.** [A new Pest of Male Fern.]—*Pharmaz. Zentralhalle*, lxviii, p. 33, 2 figs. Dresden, 1927. (Abstract in *Z. Pfl Krankh.*, xxxviii, no. 9–10, p. 312. Stuttgart, 1928.)

The Capsid, *Bryocoris pteridis*, Fall., was observed in numbers injuring the fronds of male fern, *Dryopteris filix-mas*, and related varieties. The fronds wither and die.

Goffart (H.). **Kalziumzyanid im Dienste des Vorratsschutzes.** [Calcium Cyanide in the Protection of stored Products.]—*Mitt. Ges. Vorratsschutz*, iv, nos. 4–5, pp. 45–47, 57–58, 11 refs. Berlin, July & September 1928.

This is a brief account of the use of calcium cyanide and Zyklon B for fumigating stored products and dwellings with hydrocyanic acid gas.

Alfken (J. D.). **Ueber das Auftreten d. Johannisbrot-Zünslers,** *Myelois ceratoniae*, **Zell., in Bremen.** [On the Occurrence of the Pyralid, *M. ceratoniae*, in Bremen.]—*Mitt. Ges. Vorratsschutz*, iv, no. 5, pp. 55–56. Berlin, September 1928.

A shipment of cork, packed in sacks and sent from Portugal to Bremen, was found to be infested with larvae of *Myelois ceratoniae*, Zell., together with a Braconid parasite, *Phanerotoma* sp., probably *P. dentata*, Pz., already recorded from this pest. The larvae of the moth had only bored into the cork for pupation, having migrated from adjoining broken cases of figs, also from Portugal.

Main (H.). **The Subterrarium and its Use for Observing the Metamorphoses of some of our Common Insects.**—*Leafl. School Nature Study Union*, no. 35, 5 pp., 16 figs. Wembley [1928].

A description is given of a simple apparatus that has been devised for the purpose of observing the subterranean activities of insects, consisting of a vertical section of earth between two sheets of glass. Satisfactory results have been obtained by fitting the glass plates into a simple frame of zinc with a cross-section of about 1⅛ ins., though the area and thickness of the section can be adapted to the needs of each case. Three holes bored through the zinc floor allow the earth to obtain moisture when the apparatus is stood in a shallow dish of water, and a wooden or zinc cover prevents the escape of active insects and reduces evaporation from the surface. Slips of wood are so placed between the earth and the glass plates that when they are removed the plate can be pushed away and slid out to allow of closer observation or of cleaning the glass. An account is given of various insects, including *Cicindela campestris*, L., the subterranean development of which has been observed by means of this apparatus.

It may also be used for studying insects that infest timber; the metamorphosis of *Lucanus cervus*, L., was thus observed in a medium of sawdust.

Walton (C. L.). **Some Observations on the Fluctuations of certain injurious Species.**—*North Western Naturalist*, iii, nos. 2–3, pp. 77–80, 124–127, 26 refs. Arbroath, June–September 1928.

Anuraphis helichrysi, Kalt., is normally very abundant in North Wales, but sometimes its numbers are greatly reduced by frosts. The eggs are laid round the base of the buds of plum trees, and may hatch before the buds are developed. In such a case, if snow or sleet occurs and freezes upon the trees, great mortality of the Aphids results. Observations on the potato Aphid [*Macrosiphum gei*, Koch] in the Bangor district during 1921–27, showed that the worst outbreaks occurred during cool weather in early summer, the insects being checked by fungi during warm, damp weather, and by parasites and predators during hot, dry periods. In North Wales in 1921, numerous young colonies of *Brevicoryne brassicae*, L., on cabbage died out owing to hot, dry days.

Plutella maculipennis, Curt. (*cruciferarum*, Zell.) has been controlled on several occasions, when seriously threatening swede crops, by sudden and violent rain storms. The lower surface of the leaves, where the larvae feed, become covered with mud, and this kills the larvae. Severe attacks of *Pegomyia hyoscyami* var. *betae*, Curt., in North Wales during June 1926 and 1927, were controlled by cold, wet weather when the larvae of the first brood were about to pupate.

Ryle (G. B.). **The Pine Shoot Tortrices.**—*Quart. J. For.*, xxii, no. 4, pp. 254–259, 4 figs. London, October 1928.

The Tortricids of the genus *Rhyacionia* (*Retinia*) of potential importance as forest pests in Britain are *R. resinella*, L., *R. buoliana*, Schiff., and *R. turionana*, Hb.

R. resinella, which is mainly confined to the northern half of Scotland, where it is very plentiful, has probably never attained the status of a

serious pest. The life-cycle takes two years, and the larva feeds externally on the shoot, protected by a resinous exudation from the stem. Pupation occurs early in May, the adults emerging towards the end of the month.

R. buoliana and *R. turionana* are apparently generally confused in Britain. Though according to Gillanders, the larvae of *R. turionana* occur in the buds of Scots pine [*Pinus sylvestris*] while *R. buoliana* is found in the leading shoots, the author, who never found the larvae of the former, observed *R. buoliana* regularly during the winter and spring in the buds, throughout the midland, eastern and southern counties of England. Larvae of the same species may cause varying degrees of damage according to whether they eat the bud completely, gnaw it on one side only, or paralyse a number of shoots of one whorl by travelling from one bud to another.

From observations on *R. buoliana* during the past four years, it is surmised that the eggs are deposited externally or in the crevices of a whorl of buds in the first half of July. The larva enters the bud and may do sufficient damage before becoming dormant for the winter to destroy or at least deform the shoot. In spring it either continues to feed within the bud or, protected by a resinous exudation, may travel from one bud to another. Various types of injury are described in detail. The larva pupates about the middle of June in the shrivelled or fissured bud or shoot, or in the axil of the whorl of young branches, and the adult emerges at the end of the month or early in July. Although the tree is only damaged when the terminal leader is attacked, the top and end shoots of the exposed branches are those most frequently selected for oviposition, young plantations of from 2 to 10 ft. in height being most liable to infestation. Larvae have, however, been found in 40 ft. pines inhabiting the disused borings of *Myelophilus piniperda*, L., while very young plantations protected by grass are seldom attacked. The Scots pine is most frequently attacked, Corsican pines [*Pinus laricio*] in close proximity to severely infested plantations of this variety often remaining practically undamaged, though sometimes they are severely attacked. *Pinus banksiana* has also been badly infested.

Hand-picking in May or June, when the infested shoots can be easily detected, is effective in controlling the Tortricid in small plantations, but no remedial measures, practicable for application to extensive areas, are known. It is suggested that the parasites, probably Braconids, found in a few instances might be isolated and cultivated, or that insectivorous birds might be encouraged by means of nesting boxes. Insecticides are useless against the larvae, since they feed internally.

FRYER (J. C. F.) & others. **Report on the Occurrence of Insect Pests on Crops in England and Wales, 1925-1927.**—*Misc. Pub. Minist. Agric.*, no. 62, 47 pp., 1 map, 1 diag., 41 refs. London, 1928. Price 2*s.* 0*d.*

The developments in the features of insect control work in Britain during the period 1925–27, here discussed, have been previously noticed in this review. Pests intercepted from abroad, some of which were noticed in the previous report [*R.A.E.*, A, xiv, 22], include *Rhagoletis cerasi*, L., in cherries from France, infestation being so severe that the importation of French cherries between the 24th June and

30th September 1927 was prohibited; *Tortrix postvittana*, Wlk., in apples from New Zealand; *Phthorimaea operculella*, Zell., in new potatoes from the Canary Islands, Spain, and Malta; *Brachycerus* sp. in *Amaryllis* bulbs from the Cape; and Lepidopterous larvae in iris bulbs and *Merodon* sp. in snowdrop bulbs, from Asia Minor. Introduced pests include *Icerya purchasi*, Mask., found in a glass house, and an Aleurodid (?*Pealius* sp.) on rhododendrons in Surrey. Further attempts have been made to introduce the Chalcid, *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hausm.]; but owing to the irregular occurrence of this Aphid in the British Isles, the climate, and the fact that *A. mali* tends to emerge in the spring before *E. lanigerum* has become abundant, it is thought that the usefulness of this parasite under English conditions will be very limited.

Detailed accounts are given of the occurrence of the more important pests of the various crops as well as of flowers, bulbs, and fruit and shade trees, together with a diagram indicating the periodical fluctuations in numbers of some of these, and a list of the species of chief commercial importance, showing their popular names and the variety of plant attacked.

THEOBALD (F. V.). **The Apple Leaf Skeletoniser (*Hemerophila pariana*, Clerck).**—*Bull. S.-E. Agric. Coll.*, no. 7, 10 pp., 5 figs. Wye, Kent, October 1928.

Hemerophila pariana, Clerck (apple leaf skeletoniser), the distribution and food-plants of which are discussed and the stages described, appeared in large numbers in 1928 near Canterbury, where the foliage of 100 acres of apple-trees was destroyed. The moths are sometimes observed in April on coltsfoot or bramble, but more generally appear in May or June. The eggs, which are laid somewhat later, on both surfaces of the apple leaves, hatch in 5–10 days, and the larvae feed on the epidermis and later on spin a web near the middle of the leaf, the edges of which are bent over. As many as 10 larvae may be found on a leaf while they are young. The larval stage lasts about 3 weeks, and pupation occurs in an elongated cocoon attached to the leaf. The average length of the pupal stage is 2 weeks, the moths emerging in July or early August, and again laying their eggs on apple foliage. The second brood larvae cause the greatest amount of damage, and as they occur when the fruit is ripe or ripening, poison sprays cannot be used. This generation, the moths of which emerge in September, hibernates, generally in the adult stage, under dead leaves, or in ricks, or the thatch of cottages or outhouses. Some hibernating pupae have also been noticed. As many of the second generation larvae are often parasitised, the number of hibernating moths is limited and the spring attack consequently slight, but the first generation does not appear to be subject to these parasites, so that the second is sometimes abnormally large. The autumn moths feed on the nectar of various flowers.

H. pariana is probably spread by means of nursery stock in the cocoon stage attached to dead leaves. When once established, it spreads by natural agencies, wind playing an important part. Of the large number of parasites recorded, the commonest in Great Britain is the Braconid, *Apanteles longicauda*, Wesm., while the Ichneumonid, *Mesochorus tachypus*, Hgn., sometimes occurs in large numbers. In one case as many as 70 per cent. of the larvae were infested by *Limneria* sp. The young larvae are also attacked by earwigs and birds.

The only means of securing complete control of *H. pariana* is the application of lead arsenate sprays with the addition of a good adhesive, and where the use of this insecticide is abandoned in favour of tar distillates, severe attacks are likely to occur.

Bodenheimer (F. S.). **Eine kleine Cocciden-Ausbeute aus Griechenland.** [A small Collection of Coccids from Greece.]—*Konowia*, vii, no. 2, pp. 191–192. Vienna, 1st September 1928.

This list includes 14 species new to Greece, bringing the total number of Coccids known from that country up to 42. Among those mentioned are *Aspidiotus lataniae*, Sign., and *Lepidosaphes ulmi*, L. (*conchiformis*, Gmel.) on fig; *Parlatoria oleae*, Colv. (*calianthina*, Berl. & Leon.), on *Pistacia lentiscus*; *Filippia oleae*, Costa, and *Pollinia pollini*, Costa, on olive; and *Pulvinaria floccifera*, Westw., on orange.

Colizza (C.). **Il moscerino delle viole** (*Dasyneura affinis*, **Kieff., Diptera Cecidomyiidae**) **nell' Italia meridionale.** [The Violet Midge, *D. affinis*, in South Italy.]—*Boll. Lab. Zool. Portici*, xxi, pp. 130–148, 6 figs., 6 refs. Portici, 25th July 1928.

Of recent years the violet plantations around Naples have been attacked by the Cecidomyiid, *Dasyneura affinis*, Kieff. Mating occurs soon after emergence, and the females oviposit on the youngest leaves, and sometimes on the flower-buds. Oviposition lasts 2–5 days and occurs particularly between noon and 3 p.m. The females may live for a week, but the males usually die 2–3 hours after mating. The larvae hatch in 4 or 5 days and form galls in the inner parts of the folds of the leaves or flower-buds. Sometimes the larvae leave the first gall and give rise to another. Pupation occurs in the gall in a cocoon, and larval and pupal development varies from a minimum of 27 days in spring and summer to a maximum of about 7 months for the fifth and last generation, the eggs of which are deposited in September, the adults emerging in April. If mature larvae are placed in slightly damp sand or earth, they behave as if in a gall, enclosing themselves in a cocoon from which the adult emerges normally. They may therefore be spread by means of soil adhering to the roots of infested plants.

In 1927 parasites reduced the infestation to an almost negligible amount. They include a Proctotrupid, *Platygaster* sp., and the Chalcids, *Tetrastichus* sp., *Torymus* sp. (possibly a variety of *T. abbreviatus*, Boh.), and *Eutelus mediterraneus*, Mayr. All these parasites hibernate in the pupal stage, *Platygaster* in the cocoon of the host, the others in the gall. Their development in summer requires 15–20 days. *Platygaster* is an endoparasite, and *Tetrastichus* an ectoparasite, of the larvae. *Torymus* is an ectoparasite of the mature larvae and pupae and lays its eggs on the galls. In the summer of 1927 it succeeded alone in checking *D. affinis* in many zones devoted to violet growing. *E. mediterraneus* is an ectoparasite.

The best measure against *D. affinis* is the collection of infested leaves every 15–20 days in summer and autumn. A less costly one consists in transplanting the violets to fresh ground after removing all the leaves, only the central buds being left. The best time for transplanting is in the second half of August. Infested leaves should be stored in cases with holes covered by glass receptacles into which the Cecidomyiid

and its parasites can enter. Honey placed in these will keep the parasites alive until all individuals of *D. affinis* have died, when the former can be liberated.

MANZONI (L.). **Tumori sul cotogno prodotti dalla** *Sesia myopaeformis*. [Tumours produced on the Quince by *S. myopaeformis*.]—*Note di Fruttic.*, 1928, no. 6, reprint 8 pp., 4 figs. Pistoia, 1st June 1928.

Swellings on the trunks and branches of quince in North Italy have been found to be inhabited by the larvae of *Aegeria* (*Sesia*) *myopaeformis*, Bkh., and are due to the irritation of the tissues caused by them. Early in May the hibernating larvae transform into pupae that partly project from the bark, and the adults emerge shortly afterwards.

[Reports on the State of Crops in each Province of Spain between 15th July and 15th August 1928.]—*Bol. Agric. téc. econ.*, Secc. oficial, xx, no. 236, pp. 562–585. Madrid, 31st August 1928.

In Huelva vineyards and cotton plantations were seriously infested by the Sphingid, *Deilephila lineata*, F. The outbreak was largely due to rains having prevented the clearance of weeds on which the young caterpillars feed before passing to vines and cotton. Removal of weeds, collection of the caterpillars, and the use of a poison-bait are the measures advocated. A good bait may be prepared by mixing 50 lb. bran with 1 lb. Paris green or calcium arsenate (or 2 lb. lead arsenate), 1½–2 gals. molasses or 8 lb. cheap sugar, and the juice of 6–8 oranges or lemons.

NONELL COMAS (J.). **El gusano de las avellanas,** *Balaninus nucum*. [The Hazel Grub, *Curculio nucum*.]—*Divulg. Estac. Fitopat. agríc. Barcelona*, no. 7, 21 pp., 8 figs. Barcelona, 1928.

The hazel, *Corylus avellana*, grown on many thousands of acres in Catalonia, is seriously attacked by the weevil, *Curculio* (*Balaninus*) *nucum*, L. A brief description of the various stages is given. The adult appears in April and May, and if too early for hazel-nuts to be available, it attacks cherries, apples, pears, walnuts, etc. Oviposition occurs in June, when the hazel-nut is half-grown. The larvae abandon the nuts at the end of July or early in August and hibernate in the ground, pupating about mid-April.

Lead arsenate sprays should be applied weekly or fortnightly to the upper branches and tender shoots from the time the adults appear till June when oviposition takes place. Up to the time when hazel-nuts become suitable for *C. nucum*, excellent results are obtained by placing halves of oranges poisoned with sodium arsenate crystals in pear and peach trees close to the hazel bushes. Some dextrine makes this bait more attractive. The collection, every 3 or 4 days, of all nuts that have fallen prematurely and the burning of weeds are also of value.

MARTIN (H.). **The Scientific Principles of Plant Protection.**—Demy 8vo, xii+316 pp. London, Edward Arnold & Co., 1928. Price 21*s.* net.

In this book on plant protection the author reviews all the known methods, both preventive and curative, of dealing with plant diseases,

and, to a certain extent, of plant pests also. The volume constitutes a book of reference on fungicides and insecticides, including fumigants, which are dealt with in considerable detail. A chapter is devoted to biological control by means of beneficial insects or fungi. Other subjects discussed include plant resistance and the influence of external factors on the susceptibility of the plant to attack.

PAILLOT (A.). **Les maladies du ver à soie. Grasserie et dysenteries.**—324 pp., 32 pls. (81 figs.). Lyon, Editions du Service photographique de l'Université, 1928. Price *Fr.* 80.

This volume is the result of three years' investigations on diseases of silkworms (*Bombyx mori*, L.). Some of these have already been noticed in this *Review* from separate papers. The methods of carrying out the work are explained. The result is a detailed and exhaustive treatise divided into three parts, dealing respectively with the normal histology and cytology of certain organs of the silkworm, with grasserie and with intestinal diseases. Gattine, an infectious disease caused by *Streptococcus bombycis*, is considered the most important, as it is the origin of many diseases with the general symptoms of flacherie. While there is no curative treatment for these intestinal diseases, cultivators are warned not to use strains of silkworms that are predisposed to gattine. The disease should be prevented as far as possible by regulating the temperature in the early stages of rearing; by adapting the number of meals to the temperature, three or four being considered sufficient at temperatures from 64° to 66° F.; by avoiding sudden changes in conditions of rearing, especially during the early moults; and by careful disinfection of the cages and rearing material.

A comprehensive bibliography is appended.

POUTIERS (R.). **Les parasites de la tordeuse de l'oeillet,** *Tortrix pronubana*, **Hb.**—*Rev. Path. vég. Ent. agric.*, xiv, no. 3, pp. 224–227, 5 refs. Paris, 1927. [Recd. 1928.]

Tortrix pronubana, Hb., which attacks the foliage of various plants and is widely distributed in France, has caused serious losses among commercially cultivated carnations on the French and Italian Riviera. The literature is briefly reviewed, including previous records of parasites. The following have been taken in the neighbourhood of Antibes: the Chalcid, *Trichogramma* (*Oophthora*) *semblidis*, Auriv., and the Proctotrupid, *Camptoptera* sp., attacking the eggs; the Braconid, *Apanteles xanthostigmus*, Hal., the Chalcid, *Elachertus affinis*, Masi, and the Tachinid, *Actia pilipennis*, Fall., parasitic on the larva; and the Ichneumonid, *Phaeogenes nigridens*, Wsm., attacking the pupa.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1928.**—*Rev. Zool. agric.*, xxvii, no. 5, pp. 69–84, 2 maps. Bordeaux, May 1928.

The situation with regard to *Leptinotarsa decemlineata*, Say, in France at the beginning of the 1928 campaign is reviewed [*cf. R.A.E.*, A, xv, 620]. On the whole few additions were made during 1927 to the infested or protective areas, since few new foci were discovered outside the previously infested zones. As a precaution, none of the zones

recently established was reduced round foci in which the beetle has now been exterminated.

The regulations concerning the transport of potatoes have been modified to allow transport by rail during the winter from one protective zone to another across uninfested territory, and from protective zones to any point in France on condition that they are clean. No potatoes are, however, allowed to be transported from infested territory. An infestation was discovered in Lot-et-Garonne for the first time in 1927. This affects an important tomato-growing area, as the importation into Britain of tomatos from places less than 25 miles from areas infested by *L. decemlineata* is prohibited.

Piédallu (A.) & Balachowsky (A.). **Utilisation de la chloropicrine contre des cochenilles nuisibles aux orangers et aux dattiers.**—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 16, pp. 671–673, 1 ref. Paris, 1928.

The authors have obtained successful results in tent fumigation with chloropicrin against Coccids on oranges and dates in Algeria. To ensure good results, evaporation of the liquid must not take longer than 45–60 minutes, and the vapour must saturate the volume exposed uniformly. Since carbon combines with chloropicrin to form substances injurious to foliage, methylated spirit, paraffin or electricity should be used to produce the heat required. With an exposure of 45 minutes, 100 per cent. mortality was obtained with 20 gm. chloropicrin per cu. m. in the case of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), on orange and *Aspidiotus lataniae*, Sign., *Diaspis zamiae*, Morg., and *Pseudococcus adonidum*, L., on *Strelitzia augusta*, and with 15–20 gm. in that of *Parlatoria blanchardi*, Targ., on date palms. Doses of 10 gm. killed only 60 per cent. of *C. ficus*. Orange trees and date palms should be fumigated after harvest and before flowering, since chloropicrin vapour is liable to scorch young shoots and flowers.

Wilkinson (D. S.). **A Revision of the Indo-Australian Species of the Genus *Apanteles* (Hym. Bracon.). Parts I & II.**—*Bull. Ent. Res.*, xix, pts. 1–2, pp. 79–105, 109–146, 3 figs. London, August & October 1928.

These papers contain descriptions of 74 species, including 16 new ones, with a key to the species and a list of hosts.

Oldham (J. N.). *Hieroxestis subcervinella*, **Wlk., an Enemy of the Banana in the Canary Islands.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 147–166, 1 pl., 15 figs., 26 refs. London, October 1928.

During September and October 1924 field observations were made in Teneriffe, Gran Canaria and Gomera on *Hieroxestis subcervinella*, Wlk., which has recently become an important pest of bananas in the Canary Islands. Notes are given on the genus *Hieroxestis*, the synonymy and distribution of *H. subcervinella* are discussed, and its various stages are described in detail. It was found in the adult or larval stages in nearly all the banana plantations visited at altitudes varying from almost sea level to 800–1,000 ft., depending on the limit of banana cultivation. The moths were principally active from dusk until midnight. Pairing and oviposition were not observed, and although

blotting paper moistened with sugar solution was provided for the moths in captivity, no feeding was noticed. The larvae usually tunnel into the plant, but may construct silken tubes covered with excrement and other débris in which they shelter. They pupate, as a rule, where they have fed, the silken cocoon, which is covered with frass and other débris, being attached to some part of the banana plant by one side. The pupal period varied from 16–20 days.

In the Canary Islands the principal food-plant was the Canary or Chinese banana (*Musa cavendishi*), though *Musa sapientum*, sugar-cane and maize are also attacked. The larvae feed to a certain extent on rubbish and have been reported as injuring bamboo. They were found living in nearly all parts of the banana plant except in the actual roots and leaf blades, the greatest injury being done in the inflorescence. They also mine in the fruit, and in one case 23 individuals were found in the pulp of a single finger. Several pieces of the root stock, which were dug up, or which projected slightly above the surface of the soil, also showed injury, but not to such a marked degree as the other parts of the plant. The entrance and exit holes afford points of attack for fungi and may also interrupt the flow of sap and affect the development of the fruit. Owing to the remarkably equable climate, bananas are cultivated all the year round, but although the injury by the pest is continuous, it is much more severe at certain seasons of the year; roughly 100 per cent. of the bunches harvested from September to December are infested, while only about 25 per cent. of those collected from April to June are attacked. *H. subcervinella* does not appear to be a native of the Canary Archipelago, and no parasites have been observed.

Ferrière (C.). **Notes on some Chalcid Parasites of Lac-insects.**— *Bull. Ent. Res.*, xix, pt. 2, pp. 171–176, 3 figs., 9 refs. London, October 1928.

Four species of parasitic Hymenoptera associated with the lac insect, *Laccifer* (*Tachardia*) *lacca*, Kerr, in Bengal are discussed, further descriptions being given of the last three to facilitate their identification. They are: the Encyrtid, *Tachardiaephagus tachardiae*, How. (*Lissencyrtus troupi*, Cam., *T. thoracicus*, Ashm.), and the Eulophids, *Coccophagus tschirchii*, Mahdihassan, and *Tetrastichus* (*Geniocerus*) *purpureus*, Cam. (*immsi*, Mahdihassan), which are all primary parasites of lac; and the Elasmid, *Elasmus claripennis*, Cam. (*colemani*, Mahdihassan) bred from larvae of *Eublemma*, a Noctuid predacious on lac. *Lissencyrtus somervilli*, Mahdihassan, is transferred to the genus *Tachardiaephagus*.

Theobald (F. V.). **Aphididae from Italian Somaliland and Eritrea.**— *Bull. Ent. Res.*, xix, pt. 2, pp. 177–180, 4 figs. London, October 1928.

The Aphids collected from Italian Somaliland include: *Macrosiphum jaceae*, L., on cultivated *Carduus*; *Aphis maidis*, Fitch, on maize (*Zea mays*); *A. tavaresi*, Del G., on lemon (*Citrus limonum*); *A. gossypii*, Glov., on cotton and cucurbits; *A. ficus*, Theo., on *Ficus sycomorus*; *A. laburni*, Kalt., on beans (*Phaseolus*) and cotton; *Paoliella hystrix*, gen. et sp. n., on *Commiphora savojae*; and *Geoica pseudosetulosa*, sp. n., on the roots of maize. Those from Eritrea are

Macrosiphum jaccae, on cultivated *Carduus*; *M. pisi*, Kalt., on beans; *Aphis maidis*, on maize; *A. nerii*, Boy., on *Calotropis procera*; *A. gossypii*, on cotton; *A. laburni*, on beans; and *Brevicoryne brassicae*, L., on cabbage (*Brassica oleracea*).

Macrosiphum dahliafolii, Theo., is considered a synonym of *M. compositae*, Theo.; it occurs on cultivated *Carduus* in Italian Somaliland and Eritrea and on various Compositae in Uganda.

Myers (J. G.). **The Incidence of a Fungal Parasite of Scale-insects in New Zealand.**—*Bull. Ent. Res.*, xix, pt. 2, p. 181, 1 ref. London, October 1928.

Aegerita webberi is recorded from New Zealand as attacking *Ctenochiton viridis*, Mask. The principal food-plants of this scale are *Nothopanax arboreum* and *Hedycarya arborea*. In a beech forest in one locality where every plant of *N. arboreum* and *H. arborea* was apparently attacked by *C. viridis*, *A. webberi* was never found on *N. arboreum*, and it is suggested that the susceptibility to fungus attack of the scales on *H. arborea* is due to the fact that this food-plant normally grows in more shady situations where humidity is greater. This view is supported by the higher percentage of infestation that occurs on the lower branches.

Barnes (H. F.). **The British Gall Midges of Peas.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 183–185, 2 figs. London, October 1928.

Notes are given on the three species of gall-midges that may be found in pea-pods, *Contarinia pisi*, Winn. [*R.A.E.*, A, xv, 62, 363], *Lestodiplosis pisi*, Barnes [xvi, 426] and *Clinodiplosis pisicola*, sp. n. The larvae of the latter species presumably feed on the sap inside the pods. They were found in pods of sweet pea in late September and soon went into the ground. Under artificial conditions the adults emerged in the following February and March. This species has also been reared in late August and early in September from larvae found in association with those of *C. pisi* on peas in late July and early August. They are not beneficial nor definitely injurious.

Hodson (W. E. H.). **The Bionomics of the Bulb Mite, *Rhizoglyphus echinopus*, Fumouze & Robin.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 187–200, 3 pls., 7 refs. London, October 1928.

In observations on *Rhizoglyphus echinopus*, F. & R. (bulb mite) during 1924–27, approximately 500 samples of narcissus, each consisting of 6–20 individual bulbs, from Britain and Holland were examined, and about 95 per cent. were found to be more or less infested. The various stages of the mite are very briefly described. It has been recorded under different names from nearly all parts of the world on a wide range of food-plants, a list of 21 species being given. Every stage of the mite was found to occur throughout the year. Eggs are laid singly, 13 being the largest number obtained from a single female, though 59 have been previously recorded. Hatching took place in about 8 days in June and 15 days in November. The life-cycle from egg to adult varied from 45 to 108 days. Nymphs frequently became inert as though about to undergo ecdysis, remained so for periods

lasting as long as four months, and eventually again became active without casting their skins. Attempts were made to account for the occurrence of these hypopi, and colonies were subjected to starvation, low atmospheric humidity and low temperature. The results were not conclusive but it seems possible that slightly unfavourable conditions, other than low temperature, may act as a stimulus to the formation of hypopi, and the mite is thus able to avoid extinction. These hypopi were frequently observed attached to *Eumerus* spp. and occasionally to *Merodon equestris*, F., which therefore act as distributing agents. Spreading also occurs when the bulbs are lifted and collected in heaps, and all stages of the mite are free to wander from bulb to bulb in search of suitable breeding-places. A Gamasid, *Hypoaspis* sp., preys on the mites, usually attacking half-grown nymphs and larvae. The facility with which it may be bred on an exclusive diet of *R. echinopus*, its voracity and the frequency of its occurrence, indicate that it is of considerable value in reducing the numbers of this pest.

Details are given of some of the numerous experiments made to determine whether *R. echinopus* is a primary or secondary parasite of bulbs. The most striking result was the total failure of all attempts to obtain injury to healthy bulbs. Mites were found to persist and feed on the dead portions of growing bulbs for periods up to 13 months, the bulbs remaining healthy throughout this time. This inability to effect injury remained even when the bulbs had been kept out of the soil for abnormally long periods and also when they had been subjected to hot water treatment before becoming infested with the mite. On the other hand bulbs that might otherwise have recovered from damage (whether caused by mechanical means or by some other organism) were destroyed by the mites, which may also carry the spores of injurious fungi from bulb to bulb. It is probable that less severely injured bulbs are able to withstand attack. Bulbs should be lifted carefully and damaged or rotting ones collected and destroyed. They should be stored under hygienic conditions, examined periodically, and the soft ones removed. Early treatment of bulbs infested with Nematodes is essential, since those having large areas of decayed tissue present prior to treatment may subsequently become infested with mites and ultimately be destroyed. Fumigation with paradichlorobenzene [*R.A.E.*, A, xv, 367] or the hot water treatment will destroy the mites.

WILKINSON (D. S.). **Two new Parasites of** *Tirathaba rufivena*, **Walk., in Malaya.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 201–202. London, October 1928.

The Ichneumonid, *Nemeritis palmaris*, sp. n., and the Braconid, *Apanteles tirathabae*, sp. n., are described, the first being bred from, and the second recorded as probably parasitic on, *Tirathaba rufivena*, Wlk., a pest of coconuts in the Federated Malay States.

MASSEE (A. M.). **An Eriophyid Mite on Apple.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 203–204, 1 fig. London, October 1928.

During 1926 and 1927 considerable damage was caused to the foliage of apple trees by the mite, *Phyllocoptes schlechtendali*, Nal., which was found in the first instance in large numbers on the foliage

of wild crab apples in 1925. It is probably generally distributed throughout England, but is not noticed unless it becomes abnormally common. The mites live on the lower surface of the leaves, causing them to fade and in cases of severe attack to dry up prematurely. In some cases the fruit also is attacked, the punctures in the epidermis causing slight pitting and speckling. Isolated individuals have also been found on pear. The mites hibernate in small numbers under bud scales and loose bark and become active as soon as the buds begin to open. The eggs have been found on the lower surface of the leaves. A description of the mite is given.

JOUBERT (C. J.). *Pseudococcus gahani*, **Green, in South Africa.**—*Bull. Ent. Res.*, xix, pt. 2, p. 209. London, October 1928.

Pseudococcus gahani, Green, was not known to occur in South Africa until the end of 1926, when it was found on pear in Cape Province. That it was not recognised earlier was perhaps due to the fact that it is very frequently associated with *P. maritimus*, Ehrh., and was therefore regarded as a form of the latter. The means by which these two species may be distinguished are given. *P. gahani* has not yet been reported from *Citrus* in South Africa.

PETTEY (F. W.) & others. **Investigations in Codling Control and Removal of Spray Residue from Pears.**—*Sci. Bull. S. Afr. Dept. Agric.*, no. 64, 36 pp. Pretoria, 1928.

This is an amplified report of experiments in connection with the control of *Cydia pomonella*, L., that have previously been noticed [*R.A.E.*, A, xvi, 305, 467].

MONTEALEGRE R. (A.). **Utilidad de un Hemíptero-heteróptero.**—*Rev. chil. Hist. nat.*, xxxi (1927), p. 126. Santiago, 1928.

The nymphs of the Pentatomid, *Comperocoris roehneri*, Philippi, prey on the larvae of *Caliroa* (*Eriocampoides*) *limacina*, Retz., and *Notolophus antiquus*, L., in Chile.

MERCET (R. G.). **Afelínidos de Chile.**

STUARDO O. (C.). **Algunas observaciones sobre tres Afelininos parásitos de** *Trialeurodes vaporariorum* **(West.) Quaint.**—*Rev. chil. Hist. nat.*, xxxi (1927), pp. 129–131, 144–149, 1 pl., 5 refs. Santiago, 1928.

The Eulophids, *Eretmocerus corni*, Hald., *Encarsia luteola*, How., and *Prospaltella citrella*, How. subsp. *porteri*, n., here recorded from Chile, are stated in the second paper to be parasites of *Trialeurodes vaporariorum*, Westw.

HINDS (W. E.). **Informe sobre la produccion de algodón en el valle de Cañete.** [Report on the Production of Cotton in the Cañete Valley, Peru.]—20 pp. Lima, Soc. nac. agrar., 1926. [Recd. 1928.]

A leaf-eating caterpillar, *Anomis* [*luridula*, Guen.] appears to be the chief pest of cotton in the Cañete Valley, Peru. Natural control

checks its abundance, but artificial measures are needed, and instead of the customary spraying, dusting with calcium arsenate or lead arsenate is advised. A simple duster has been devised [*R.A.E.*, A, xiv, 545], and as the life-cycle of this moth requires about 25 days, the dust should be applied every 4 weeks. A dust of 1 lb. 40 per cent. nicotine sulphate and 16 lb. of calcium arsenate or slaked lime is effective against *Aphis gossypii*, Glov. An account of the bionomics of the cotton square weevil, *Anthonomus vestitus*, Boh., is given [A, xv, 597].

Box (H. E.). **Preliminary Report upon the Occurrence in Argentina of a Species of *Diatraea* new to the American Fauna.**—*Ref. Bk. Sugar Indust. World 1928*, reprint 3 pp., 2 figs., 1 ref. New Orleans, La., July 1928.

Numerous samples of sugar-cane from Jujuy were found to be attacked by a species of *Diatraea* apparently distinct from any recorded in America. This species has not yet been found in Tucumán but in Jujuy it is widely distributed and in some localities appears to have gradually crowded out *D. saccharalis*, F. The characters differentiating the two species are described. They also differ in their form of attack on sugar-cane, the unidentified species being capable of more serious damage, as it generally makes a series of long tunnels the whole length of the infested stalk, often passing through seven or eight successive internodes. It does not apparently bore transversely through the stalk, severing three-fourths or more of the vascular system, which is a form of injury characteristic of attack by *D. saccharalis*. The eggs of the former species are parasitised by *Trichogramma minutum*, Riley, while the natural enemies of the larvae include *Sarcophaga diatraeae*, Brèthes, the commonest parasite of *D. saccharalis* in Tucumán, two species of *Microdus* and possibly three species of *Ipobracon*.

Cleare, jr. (L. D.). **Notes on an Outbreak of Yellow Sugar-cane Aphis.**—*Agric. J. Br. Guiana*, i, no. 3, pp. 149–154, 3 pls., 2 figs. Georgetown, September 1928.

Sipha flava, Forbes (yellow sugar-cane aphis) was recorded in March 1927 for the first time on sugar-cane in British Guiana, where it occurred over a period of 8 months throughout the sugar-growing area of the coastal region, which is some 90–100 miles in extent. It generally occurs on the lower surface of the more mature leaves and remains unobserved until the attack is far advanced. The plants attacked were generally from 2 to 4 ft. high, but newly planted cane was also infested. The Aphids reduce the vitality of the plant either by mechanical injury or by admitting fungi or bacteria. Attacked foliage becomes discoloured and finally turns brown and dies.

Though the Aphids were widely distributed, the individual infested areas were not large, nor was it usual to find the entire stool killed except where the plants were weak, or where the Aphid was fostered by the ant, *Solenopsis geminata*, F. In some cases the attack of the Aphid was followed by a sooty mould, which, however, did not cause other than mechanical injury to the plant.

Many insects were attracted in the later stages of the infestation by the sweet excretions of the Aphids. The most important natural enemies observed were the Coccinellids, *Cycloneda* (*Neda*) *sanguinea*, L., and *Ceratomegilla* (*Megilla*) *maculata*, DeG., which were chiefly responsible for its control, the Syrphid, *Ocyptamus dimidiatus*, F., and the lacewing, *Homalotylus flaminius*, Dalm. A white fungus, probably *Acrostalagmus albus*, was in one case an important factor in controlling the attack. Owing to the activities of natural enemies, the actual damage inflicted was not in proportion to the appearance of the fields, and in cases where infestation persisted for several months, other conditions inimical to the plant were present, such as ineffective or insufficient drainage.

CLEARE, jr. (L. D.). **The Paddy Bug** (*Mormidea poecila*, **Dall.**).—*Agric. J. Br. Guiana*, i, no. 3, pp. 154–158, 1 pl., 1 fig. Georgetown, September 1928.

The Pentatomid, *Mormidea poecila*, Dall. (paddy bug), a major pest of rice in British Guiana, is briefly described. The rice is attacked just as the husks close and the formation of grain begins, the glumes being, at this stage, soft and easily pierced by the bug, which sucks the contents. The attack is thus of short duration, the insects often passing from one rice bed to another. Both nymphs and adults attack the plants, and where infestation is severe, several may be seen at once on a single head. Heads that have been attacked fail to form grain, and what is known as " wind rice " is produced, though this may also result from other causes. Instructions are given for the construction of hand nets with which large numbers of the bugs may be caught by sweeping over the plants attacked. The best results can only be secured by co-operation of all growers in an infested district.

BRUNER (S. C.) & ARANGO (O.). **Nota sobre la " cotorrita " de Australia.** [Note the Australian Coccinellid, *Novius cardinalis*.]—*Rev. Agric. Com. Trab.*, x, no. 1, pp. 30–31, 2 figs. Havana, July 1928.

The scale, *Icerya purchasi*, Mask., was introduced into Cuba two years or more ago, and in view of its spread, the Coccinellid, *Novius* (*Rodolia*) *cardinalis*, Muls., has been imported from Florida and steps are being taken to establish it in various localities.

RUSSO (G.). **Insectos dañinos a los principales cultivos y medios de combatirlos.** [Insects injurious to the chief Crops and Means for combating them.]—*Circ. Lab. Ent. Estac. nac. agron. Moca*, no. 1, 31 pp. Santo Domingo, R.D., 1927.

Pests dealt with in this popular circular and not mentioned in previous reports from San Domingo [*R.A.E.*, A, xvi, 17, 67, 68] are *Pseudococcus* sp. on cacao ; *Pseudoparlatoria* sp. on papaya ; *Diaphania* (*Margaronia*) *hyalinata*, L., and *Aphis gossypii*, Glov., on pumpkins ; and the termites, *Nasutitermes morio*, Latr., and *Calotermes* sp., infesting trees and timber.

Russo (G.). **Las enfermedades perjudiciales al cultivo de cebolla.** [The Diseases and Pests harmful to Onion Cultivation.]—*Circ. Lab. Ent. Estac. nac. agron. Moca*, no. 2, 25 pp., 6 pls. Santo Domingo, R.D., 1928.

For combating the onion thrips, *Thrips tabaci*, Lind., in San Domingo, sprays of oil emulsion, tobacco-soap, and lime-sulphur are recommended. The Coccinellid, *Ceratomegilla* (*Megilla*) *maculata*, DeG., preys on the larvae and nymphs. The Chalcid, *Thripoctenus brui*, Vuillet, is not an effective parasite.

Ogilvie (L.). **The Insects of Bermuda.** —8vo, 52 pp., 1 fig. [Hamilton] Dept. Agric. Bermuda, 1928.

In this check list, the food-plants of the various insects are indicated, and brief biological and other notes are included on a few species, particularly those of economic importance. Insects intercepted in quarantine are also mentioned. In an appendix, *Aphis ogilviei*, sp.n., is described by F. V. Theobald from *Lilium harrisi*.

Carter (W.). **Transmission of the Virus of Curly-top of Sugar-beets through different Solutions.** —*Phytopathology*, xviii, no. 8, pp. 675–679, 1 ref. Lancaster, Pa., August 1928.

The author was successful in transmitting curly-top of sugar-beet by *Eutettix tenella*, Baker, when the insects were fed on a suspension of crushed infective leafhoppers in weak aqueous solutions of various sugars, or on diseased beet juice in a 1 per cent. aqueous solution of sucrose, or on a solution on which infective leafhoppers had previously fed, the incubation periods in these cases usually being prolonged.

Severin (H. H. P.) & Swezy (O.). **Filtration Experiments on Curly-top of Sugar-beets.** —*Phytopathology*, xviii, no. 8, pp. 681–690, 1 pl., 2 figs., 4 refs. Lancaster, Pa., August 1928.

Non-infective beet leafhoppers, *Eutettix tenella*, Baker, fed on root juice expressed from sugar-beet affected by curly-top, and filtered through coarse, medium and fine Berkefeld candles, transmitted the disease to healthy sugar-beets. A rapid inactivation of the virus begins after the first day in both filtered and unfiltered root juice, when exposed to the air through mouth-part punctures in the membrane. Non-infective leafhoppers, after feeding on a culture medium in which infected leafhoppers were macerated, centrifuged and filtered through a fine Berkefeld candle, also transmitted the disease. The leafhoppers were kept fasting for 24 hours before maceration, in order that the food in the digestive canal might be eliminated, to avoid the transmission of unchanged diseased beet juice.

It is evident, therefore, that a filterable stage of the virus occurs both in beets and in the leafhopper.

Severin (H. H. P.) & Henderson (C.F.). **Some Host Plants of Curly-top.**—*Hilgardia*, iii, no. 13, pp. 339–384, 4 pls., 24 figs., 7 refs. Berkeley, Cal., June 1928.

As a result of ploughing under 30,000 acres of beets in California in consequence of a disastrous outbreak of curly-top in 1918–19, *Eutettix*

tenella, Baker (beet leafhopper), the vector of the disease, was forced to seek other food-plants. Various other plants, including melons, spinach and beans, were found to be infested with the disease in subsequent years, and in 1925 and 1926 curly-top was transmitted to sugar-beets from many varieties of squashes and pumpkins naturally infected in the field. The general failure of the squash crop in the north-west in 1926 was due to this disease [*R.A.E.*, A, xv, 282]. An investigation was undertaken to determine what economic plants and weeds are naturally infected with the disease, and experiments were at the same time conducted in the greenhouse to ascertain what varieties of cultivated plants are immune, resistant or susceptible. This paper gives the results of these investigations concerning economic plants and weeds of the families Chenopodiaceae, Leguminosae and Cucurbitaceae. The methods employed in testing plants naturally infected with curly-top are described, together with those used in experimentally infecting plants with the disease.

Migrations of the leafhopper take place in the spring when vegetation becomes dry in the breeding ground, and flights also occur during the summer in cultivated areas where the food, owing to disease or scorching of the foliage by the sun, becomes unfavourable. During October and November, the overwintering adults fly from cultivated areas in the valleys to the plains and foothills in which the breeding areas are situated. No overwintering leafhoppers were taken in early-planted beet fields, nor was a single case of curly-top observed until after the migratory flights had occurred. Hot dry summers are favourable to the immigrants and later generations in cultivated areas.

A planting schedule, relating to the spring and autumn dispersal of *E. tenella* in natural breeding areas, has been drawn up for sugar-beet and should also be followed for mangels, garden beet, Swiss chard and spinach. Beet should be planted in December, January and February in the San Joaquin and Sacramento valleys, where the spring dispersal into the cultivated areas usually occurs in April. If the foliage of the sugar-beet covers the rows at the time of the invasion of *E. tenella*, a good crop can usually be obtained. In 1925 when a serious outbreak of the leafhopper caused the destruction of beets planted in March and April, those planted after the migratory flights ceased in May produced a marketable crop. The harvesting of a good crop will be assured by the continued practice of early planting, while serious losses will result from late planting during March and April year after year whenever large migrations occur. Planting should be discontinued in the fog belt from 1st March until after the spring flights cease in May and June, though where a partial second brood occurs, later plantings may become infested. Not a single plant of a naturally resistant strain of beans, planted in 1926 where an outbreak of curly-top had previously occurred, has yet been found to be naturally infected with the disease.

HOTTES (F. C.). **Borderline Aphid Studies.**—*Proc. Biol. Soc. Wash.*, xli, no. 31, pp. 133–138. Washington, D.C., 15th October 1928.

This paper discusses the phylogenetic significance of the variability in biological behaviour in Aphids, in respect of polyphagy, reproduction and apterism.

Miller (P. W.). **A Preliminary Report on Studies of Fireblight of Apple.**—*Science*, lxviii, no. 1764, pp. 386–388, 6 refs. New York, N.Y., 19th October 1928.

Being unable to find conclusive evidence in literature of the firmly established belief that insects are the agents that first establish the fireblight organism (*Bacillus amylovorus*) in the current year's growth of fruit-trees, the author studied the problem in Wisconsin during 1926–28. Carefully excluding all possibility of insect contamination, the results of his experiments and observations were that rain is an important agent in disseminating both the primary and secondary inoculations of fireblight of apple, which can infect young leaves and unopened apple and pear blossoms in the absence of wounds, and that this organism may cause infection following penetration through the stomata. The part played by insects in the dissemination of fireblight appears, therefore, to be less important than has been believed.

Granovsky (A. A.). **A new Genus and Species of Aphididae (Homoptera).**—*Proc. Ent. Soc. Wash.*, xxx, no. 7, pp. 113–121, 1 pl., 5 refs. Washington, D.C., 12th October 1928.

Cepegillettea betulaefoliae, gen. et sp. n., is described from white paper birch (*Betula papyrifera*) in Wisconsin. It also occurs in British Columbia on *B. occidentalis*. The Aphids feed singly or sometimes in small groups on the lower surface of the leaves. They usually occur in dense foliage and apparently require shade and moisture. Oviparous females were invariably taken about a foot from the ground, where they deposit their eggs near the buds of young birch sprouts. *Calaphis myricae*, Patch, described from sweet fern (*Myrica asplenifolia*) is also referred to this new genus. Keys are given to the alate and apterous viviparous females of the two species.

Fouts (R.). **Notes on the Bethylinae with Descriptions of one new Cuban and twelve new North American Species (Hym.).**—*Proc. Ent. Soc. Wash.*, xxx, no. 7, pp. 121–132. Washington, D.C., 12th October 1928.

Keys are given to the North American species of the genera *Pseudisobrachium*, Kieffer, and *Goniozus*, Förster. Of the 19 species dealt with, 12 are new; these include *G. longinervis* from Nebraska parasitic on *Rhyacionia frustrana bushnelli*, Busck, and *G. electus* from Louisiana on *R. frustrana*, Comst.

G. platynotae, Ashm., and *G. columbianus*, Ashm., are recorded from various parts of the United States; the former has been reared from larvae of *Tortrix* (*Cacoecia*) *rosaceana*, Harr., in Washington, D.C., and *Eulia velutinana*, Wlk. (red-banded leafroller) in Virginia, and the latter from *Cydia* (*Grapholitha*) *molesta*, Busck, in Virginia, and *Polychrosis viteana*, Clem. (grape-berry moth) in Pennsylvania.

Jaques (H. E.). [**Reports on the May Beetles in Iowa.**]—*Proc. Iowa Acad. Sci.*, xxxiii, pp. 337–339, 2 refs.; xxxiv, pp. 314–315, 3 refs. Des Moines, 1926 & 1927.

Lists are given of the species of *Lachnosterna* (*Phyllophaga*) collected in various parts of Iowa, and 31 species in all are recorded from that

State. The genus in North America is represented by some 90 species. Many of these have a three-year life-cycle, and this involves serious damage to crops every third year. In Iowa the adults appear from early in April until well through the summer of the year preceding the larval attack.

Wolcott (G. N.). **Increase of insect-transmitted Plant Disease and Insect Damage through Weed Destruction in tropical Agriculture.** —*Ecology*, ix, no. 4, pp. 461–466, 3 refs. Brooklyn, N.Y., October 1928.

Aphis maidis, Fitch, which is the vector of sugar-cane mosaic, has an obvious dislike for the juice of sugar-cane, as has been repeatedly proved in trying to induce the Aphids to remain on the cane plants in transmission experiments. It is only when the small grasses that are its natural food-plants are destroyed that this Aphid passes to sugar-cane. A single experiment showed that the more often cane fields are weeded, the greater is the mosaic disease of the sugar-cane, but this has not been confirmed. An instance of insects feeding on a cultivated crop when their natural food-plant is destroyed is that of the cutworms, *Prodenia ornithogalli*, Guen., and *Xylomyges sunia*, Guen., which feed normally on *Boerhaavia erecta*, being forced to attack the leaves of cotton and even sisal on a plantation in Haiti.

Metcalf (C. L.) & Flint (W. P.). **Destructive and Useful Insects. Their Habits and Control.**—8vo, xii+918 pp., 561 figs. New York & London, McGraw-Hill Pubg. Co. Ltd., 1928. Price 37*s.* 6*d.*

This is an excellent textbook for the entomological student and also a useful reference book for farmers and others interested in insect pests. It is the result of twenty-five years of practical work in combating destructive insects and presents the essentials of economic entomology in a simple and straightforward manner. In the first ten chapters the fundamentals of technical entomology are explained, two dealing with insect control and insecticide apparatus respectively, while in the remaining thirteen the more important pests of the chief crops in the United States and southern Canada are discussed. A key is given at the beginning of each chapter for the determination of the insects dealt with, followed by a brief description of the characteristic injury done by each and of its stages, and a few references to other literature. Natural enemies are only mentioned when of assistance in control. A comprehensive index is appended.

McDaniel (E. I.). **The Spruce Tortrix damages ornamental Trees.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xi, no. 1, pp. 25–26, 1 fig. East Lansing, Mich., August 1928.

Olethreutes abietana, Fern. (spruce tortrix), which is widely distributed throughout the forest areas from Colorado to New England, apparently confines its attacks to Engelmann spruce and blue spruce [*Picea engelmanni* and *P. pungens*], sometimes severely injuring isolated trees. There are two generations a year. When the larvae are mature or nearly so, they enclose the pinnules hollowed out by them,

in which they probably hibernate, within a waterproof web of sooty appearance. There is usually only one larva in each nest, and the terminal growth on the lower part of the tree is preferred. The pupal stage is of short duration and is passed in a tough, compact cocoon within the nest. Adults emerge when the new shoots are about an inch long. The larva, pupa and adult are briefly described.

The removal and burning of the nests in autumn or very early spring is the only satisfactory method of control. A dormant spray of oil emulsion or miscible oil, if applied with pressure in early spring, may be of some value.

Beckwith (C. S.). **Cranberry Insects.**—*Proc. Amer. Cranb. Gr. Ass.*, lviii, pp. 14–15, 1928. (Abstract in *Expt. Sta. Rec.*, lix, no. 3, pp. 249–250. Washington, D.C., 1928.)

The three most important insects infesting cranberry bogs, as judged by the number of individuals present, are *Euscelis striatulus*, Fall. (blunt-nosed leafhopper) and *Platymetopius frontalis*, Van D. (sharp-nosed leafhopper), both of which are said to be present in Massachusetts and Wisconsin but not in the Washington-Oregon section, and *Thamnotettix smithi*, Van D. (yellow leafhopper). Since false blossom is present in all sections, but does not spread in Washington or Oregon, it is possible that one or both of the first-named leafhoppers are the carriers of this disease.

Dobrosky (I. B.). **Insect Studies in Relation to Cranberry False-blossom Disease.**—*Proc. Amer. Cranb. Gr. Ass.*, lviii, pp. 6, 7, 10, 11, 3 figs., 1928. (Abstract in *Expt. Sta. Rec.*, lix, no. 3, p. 250. Washington, D.C., 1928.)

Phylloscelis atra, Germ. (toad bug), *Gypona octolineata*, Say (large green leafhopper) and *Platymetopius magdalensis*, Prov. (sharp-nosed leafhopper) all failed in a limited number of experiments carried out in 1924 and 1925 to transmit false blossom disease to cranberries. *Euscelis striatulus*, Fall. (blunt-nosed leafhopper) is suspected of being the carrier on account of its presence in regions where false blossom occurs and because of its abundance and activity in bogs in New Jersey in 1926 when the disease was spreading rapidly.

Smith (M. R.). **Controlling common Mississippi Ants.**—*Quart. Bull. Miss. Pl. Bd.*, viii, no. 2, pp. 1–6. A. & M. College, Miss., July 1928.

Of the 106 species of ants known in Mississippi, 11 are enumerated as being of sufficient importance frequently to require control measures, and these are briefly explained.

Entomology.—*46th Ann. Rep. Ohio Agric. Expt. Sta. 1926–27*, Bull. 417, pp. 42–50. Wooster, Ohio, March 1928.

The work in connection with *Pyrausta nubilalis*, Hb., during the year was of a preliminary nature, very few conclusive results having so far

been reached [*cf. R.A.E.*, A, xvi, 323]. Maize was also attacked by *Oligia fractilinea*, Grote (heart worm) and *Diabrotica duodecimpunctata*, Oliv. (southern corn root worm), the former being particularly destructive in eastern and south-eastern Ohio. In some fields as much as 50 per cent. of the crop was damaged. The injured plants wilt, turn black and die. The injury was found to be confined to fields that had been planted with timothy grass in the previous year. Summer observations clearly indicated that *O. fractilinea* primarily attacks this grass and that infestation of maize may possibly be prevented by rotation methods and early autumn ploughing where maize is to follow timothy. A few larvae were still feeding in the last week of June, though most of the injury is done during the first half of the month. Pupation occurs during the latter part of July, the moths emerging two weeks later. *D. duodecimpunctata* was particularly prevalent in southern Ohio, attacking the roots of the plants; as many as 60 larvae were found in a single hill. It occurred irrespectively of whether maize or grass was growing in the field during the previous year.

A survey of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) indicates that this moth is well distributed throughout the State and that severe losses may be expected. In one orchard near Columbus 56 per cent. of the fruit was found to be infested at harvest time.

The European red mite [*Paratetranychus pilosus*, C. & F.] is only of importance in northern Ohio, where apples, plums and peaches are the main food-plants. *Aphis pomi*, DeG. (green apple aphis) was the chief pest of apples. Experiments showed that delayed dormant sprays will not control infestations that begin from Aphids migrating to the apple and are favoured by weather conditions. The infestation of 1927 was begun mostly by migrants from other food-plants rather than by those hatching from overwintering eggs on apple. A dilute oil emulsion and nicotine spray, applied in mid-July when the infestation was at its height, gave the best results, the formula recommended being 1 pint nicotine sulphate and $\frac{3}{4}$ gal. oil to 100 gals. water. Infestations by *Anuraphis roseus*, Baker (rosy apple aphis) and *Rhopalosiphum prunifoliae*, Fitch (apple-grain aphis) were very light.

Experiments for the control of the codling moth [*Cydia pomonella*, L.] have again shown the superiority of sprays over dusts. Apple leaf-hoppers [*Empoasca fabae*, Harr.] were more abundant during 1927 than usual. Over 99 per cent. of the nymphs were destroyed by lime-sulphur, 1 : 50, plus nicotine sulphate, 1 : 800, applied at the time of the petal fall. Never more than 30 per cent. were killed by summer oil sprays. Up to 50 per cent. of the overwintering eggs were killed by delayed dormant oil sprays; this is, however, considered of little benefit. At temperatures above 80° F., good results were obtained on calm days with a 2·5 per cent. nicotine dust.

A large number of insects attack potatoes; of these special attention is being given to *Pnyxia scabiei*, Hopkins (potato scab gnat), which was relatively common during 1927. This pest may be spread through infested seed potatoes and may also spread from infested to healthy potatoes in storage.

Pegomyia hyoscyami, Panz., infests both beet and spinach; various spray combinations, including oils with and without nicotine sulphate, produced an increased yield over the untreated plots. The best results were obtained with a 1 per cent. engine oil emulsion with the

addition of nicotine sulphate, 1 : 800. As frequent applications are necessary, the cost of this treatment is prohibitive except in the case of beets forced for early market.

The greenhouse pests recorded are *Scutigerella immaculata*, Newp. (garden centipede), for the control of which paradichlorobenzene [*R.A.E.*, A, xvi, 518] is recommended; *Phlyctaenia rubigalis*, Gn. (*ferrugalis*, auct.), attacking ornamental plants and vegetables, but controlled in the adult stage by calcium cyanide fumigation and in the larval stage by spraying with arsenicals; *Thrips impar*, Hood, occurring on *Cineraria* and recorded for the first time from Ohio; and *T. tabaci* Lind. (onion thrips), causing serious injury to cucumber. Derrisol at the rate of 1 : 400 destroyed 97 per cent. of *T. tabaci*, and similar results were obtained with a commercial oil emulsion at the rate of 1 : 100 together with nicotine sulphate, 1 : 800. As the eggs are embedded in the leaf tissues, spraying must be repeated after 5–7 days, when they have hatched.

Davis (J. J.). **Insect Problems in the Home.**—*Circ. Indiana Agric. Expt. Sta.*, no. 150, 24 pp., 12 figs. Lafayette, Ind., March 1928.

This circular gives a short and popular account of the bionomics and control of the more important household pests in Indiana.

Davis (J. J.). **Insects of Indiana for 1927.**—*Proc. Indiana Acad. Sci.*, xxxvii (1927), pp. 445–460, 6 figs. Brookville, Ind., 1928.

The majority of the pests recorded in Indiana during 1927 are of common occurrence and have been noticed in earlier reports [*R.A.E.*, A, xiii, 262; xv, 4; xvi, 162]. Among the more serious ones were *Diabrotica duodecimpunctata*, F. (southern corn root worm), which was more numerous than during the last 15 years and one of the most destructive maize pests; *Lachnosterna* spp., the larvae of which were more injurious than for many years and are expected to do much damage in three years' time; *Pyrausta nubilalis*, Hb. (European corn borer), first discovered in Indiana in 1926, which appeared in 10 additional counties, though an intensive campaign against it checked the rate of increase; *Papaipema nitela*, Gn. (common stalk borer); the bagworm, *Thyridopteryx ephemeraeformis*, Haw., which defoliated many kinds of trees in the southern half of the State; and the Aphids, *Periphyllus lyropictus*, Kessler (Norway maple aphis) and *Drepanosiphum acerifoliae* Thos., on maple, *Chaitophorus negundinis*, Thos., on box-elder [*Acer negundo*], *Myzocallis* (*Callipterus*) *ulmifolii*, Monl., on elm, and *Therioaphis* (*C.*) *tiliae*, L., on lime. *Prociphilus erigeronensis*, Thos. (aster woolly root aphis) is a common pest of asters and other garden plants.

Less common pests included *Chaetocnema pulicaria*, Melsh. (corn flea-beetle) on maize; *Lycophotia* (*Peridroma*) *margaritosa*, Haw. (variegated cutworm) in greenhouses, particularly on tomato; *Lixus concavus*, Say, on rhubarb; *Diaphania nitidalis*, Stoll, on cucumbers; *Protoparce* (*Phlegethontius*) *quinquemaculata*, Haw., on tomato; *Nezara* (*Acrosternum*) *hilaris*, Say, on peaches, the nymphs feeding on the fruit; *Hysteroneura setariae*, Thos. (rusty-brown plum aphis) on plums; *Datana ministra*, Drury, on apple; *Podosesia fraxini*, Lug. (ash tree borer) on ash; and *Macronoctua onusta*, Grt. (iris borer).

Doak (K. D.). **Records of Blueberry Insects in Indiana.**—*Proc. Indiana Acad. Sci.*, xxxvii (1927), pp. 441–444, 1 fig. Brookville, Ind., 1928.

While the cultivation of blueberries is not of economic importance, *Vaccinium corymbosum*, *V. pennsylvanicum* and *V. vacillans* are native species and generally adapted to the acid peat and sandy soils in northern Indiana. Adults of *Galerucella cavicollis*, Lec., caused considerable damage to *V. corymbosum* by eating the young growing tips of the lateral shoots and partly defoliating the bushes. A small white Dipterous larva, probably that of *Rhagoletis pomonella*, Walsh (apple maggot), occurred singly in the berries of *V. vacillans* and *V. pennsylvanicum* in dry localities. A small Lepidopterous larva was found in dried fruits that remained on the bushes after the normal ones had ripened and dropped, but since it was observed only late in the season, it apparently merely caused slight damage. *Hemadas nubilipennis*, Ashm., formed galls on the young wood of *V. corymbosum* and *V. pennsylvanicum* produced during the current season, which resulted in a decrease of fruiting surface, since fruit is only borne on shoots made in the previous season. The terminal shoots were more often attacked than the more slowly growing laterals, and this fact, together with the widespread occurrence of the insect, makes it a serious pest. Young leaves were webbed together by larvae of the Tineid, *Telphusa latifasciella*, Cham., in May. Pupation had occurred before 30th May, and the first adult moths emerged before 14th June. The tied leaves seldom make further growth, and considerable injury may result.

Porter (B. A.), U.S. Bur. Ent., & Steiner (L. F.). **The Codling Moth in Indiana.**—*Circ. Indiana Agric. Expt. Sta.*, no. 151, 28 pp., 18 figs. Lafayette, Ind., March 1928.

This is a popular account of current information regarding the codling moth [*Cydia pomonella*, L.] for the benefit of apple growers of Indiana.

Ryan (H. J.). **Juniper Webworm,** *Dichomeris marginella*, **Fabr. Infestation in Los Angeles apparently eradicated.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 1, pp. 17–19, 1 fig., 5 refs. Sacramento, Cal., January 1928.

An account is given of an isolated infestation in California of juniper (*Juniperus communis* var. *hibernica*) by *Dichomeris marginella*, F., the trees having been introduced in an infested condition from England. The life-history and remedial measures are quoted from another source [*R.A.E.*, A, x, 279]. For several years the infestation was held more or less in check by hand-picking; eventually the trees were destroyed, and no other infestations having been found in the vicinity, it is presumed that the insect has been eradicated from the State.

Ryan (H. J.). **Seasonal Control of Citrophilus Mealybug.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 1, pp. 53–54. Sacramento, Cal., January 1928.

Following upon a careful inspection of *Citrus* orchards and the location of the heaviest infestations of the citrophilus mealybug [*Pseudococcus gahani*, Green], approximately 4,000,000 adults of *Cryptolaemus*

[*montrouzieri*, Muls.] were liberated in Los Angeles county over an area of 4,775 acres, using 10 adult beetles to each tree. Although prolonged cool, damp weather delayed the activities of the Coccinellid at first, later on the control for the season became entirely satisfactory, resulting in a minimum of infestation.

Lewis (H. C.). **Seasonal Insect Control Notes.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 3, pp. 204–212, 7 figs. Sacramento, Cal., March 1928.

These notes, compiled from various sources, deal with some of the more important insects attacking deciduous fruits in California, and are necessarily of a general character. The pests discussed include *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth), *Epitrimerus pyri*, Nal. (pear-leaf rust-mite), *Eriophyes pyri*, Pgst. (pear-leaf blister-mite), *Heliothrips fasciatus*, Perg. (bean thrips), *Hyalopterus arundinis*, F. (mealy plum aphis), *Palaeacrita vernata*, Peck (spring cankerworm), *Anarsia lineatella*, Zell. (peach twig borer) and *Tetranychus telarius*, L. (red spider).

Crane (H. A.). **Mealy Plum Louse found in Dormant Fruit Buds.**—*Mon. Bull. California Dept., Agric.*, xvii, no. 4, p. 291. Sacramento, Cal., April 1928.

Numbers of eggs of *Hyalopterus arundinis*, F. (mealy plum aphis) were found on prune and plum in Yuba county during January. The majority of these eggs, which in every case were laid under the buds on the previous year's growth, had hatched by 2nd February, after a short period of warm weather. Subsequent observations indicated that while a large number of the Aphids perished, enough survived to cause an infestation under favourable conditions.

Mackie (D. B.). **An Investigation of the Mexican Fruit Fly,** *Anastrepha ludens* **(Loew), in the Lower Rio Grande Valley of Texas.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 5, pp. 295–323, 7 figs. Sacramento, Cal., May 1928.

In the first part of this paper the history of the discovery of *Anastrepha ludens*, Loew (Mexican fruit-fly) in the Lower Rio Grande Valley of Texas [*R.A.E.*, A, xv, 543] and the measures taken by both State and Federal authorities to eradicate it are reviewed. In the second part the author discusses various factors bearing on the situation, such as the topography of the regulated area, the types of soil and their effect on the vegetation, the climate, direction of the wind, the species of wild plants, and the cultivated plants both on commercial and on residential properties, and the possibility of their becoming food-plants of *A. ludens*. Since the regulations for the control of this fruit-fly came into force [*R.A.E.*, A, xv, 668], no infested fruit has been found in the quarantined area.

Myers, jr. (L. E.). **The Mexican Mealybug,** *Phenacoccus gossypii* **(Townsend & Cockerell).**—*Mon. Bull. California Dept. Agric.*, xvii, no. 6, pp. 355–358, 1 fig., 1 ref. Sacramento, Cal., June 1928.

The mealybug originally determined as *Phenacoccus colemani*, Ehrh., by which name it has been commonly known in California for

several years, has now been identified with *P. gossypii*, Towns. & Ckll., which was originally described from Mexico on cotton. *P. gossypii*, which is not apparently a native of California, becomes at times rather a serious pest of various ornamental plants there and has also been taken on *Citrus*, and it is thought that it may eventually become a pest of major importance. Its local distribution is discussed, and a re-description of it is given.

Moulton (D.). **The Greenhouse Thrips** (*Heliothrips haemorrhoidalis* **Bouché**).—*Mon. Bull. California Dept. Agric.*, xvii, no. 6, pp. 366–367, 1 fig. Sacramento, Cal., June 1928.

This paper, which is the first of a series intended to facilitate the recognition of certain species of thrips, describes the distinguishing characters of *Heliothrips haemorrhoidalis*, Bch., which is found under glass in cold climates and in the open in tropical and semi-tropical countries. Some account is given of its very numerous food-plants.

Ryan (H. J.). **Cork Oak Midge Infestations.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 7, p. 429. Sacramento, Cal., July 1928.

Early in 1927 cork oaks [*Quercus suber*] from Europe were seriously injured in California by the Cynipid, *Plagiotrochus suberi*, Weld. The trees were severely pruned, and the trash carefully burned. Inspections in 1928 indicated that this method of control was successful. Since that time, further infestations have been found in widely scattered localities. Apparently this insect, which was imported from Europe, has occurred in California for a number of years, but has spread slowly, as it seems to attack only the cork oak and does not occur generally.

Moulton (D.). **The Grape Thrips** (*Drepanothrips reuteri* **Uzel**).—*Mon. Bull. California Dept. Agric.*, xvii, no. 8, pp. 455–457, 2 figs. Sacramento, Cal., August 1928.

The occurrence of *Drepanothrips reuteri*, Uzel (grape thrips) in Europe and California [*R.A.E.*, A, xiv, 637] is discussed. It is distributed throughout the grape-growing district of central California, where it causes considerable damage by attacking the green shoots, foliage and fruit of the vines. It is closely related to *Scirtothrips citri*, Moulton (orange thrips), and the author suggests that it may be controlled by the same type of spray.

In an additional note, H.C. Lewis states that control measures should be started as soon as the first evidence of injury is observed. Under very favourable weather conditions, such as still warm days, reasonable results may be expected from a thorough application of a dust containing not less than 6 per cent. nicotine sulphate. Where power spraying equipment is available, a spray of 1½–2 gals. highly refined oil emulsion and 1½ pts. nicotine sulphate in 200 gals. water is recommended.

Lewis (H. C.) & Gammon (C.). **The Vegetable Weevil for the Season 1927-28.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 9, pp. 482–492, 7 figs. Sacramento, Cal., September 1928.

As a result of the marked spread of *Listroderes obliquus*, Gyll., during the last two and a half seasons in California, a detailed study of its

life-history and control has been made. Weevils, driven by starvation from a field from which turnips had been removed, migrated to an adjoining field of leeks, on which they fed and matured. The list of vegetable food-plants given is already large, and it seems probable that under certain conditions this weevil will feed on almost any green and succulent plant. The seasonal history is discussed [*R.A.E.*, A, xiv, 153]. There is one generation annually, with considerable overlapping of the stages, and the insect is active during autumn, winter and spring. The rate of spread by natural means appears to vary from $1\frac{1}{4}$ to $1\frac{1}{2}$ miles a season. Though adults have never been observed in flight, some dispersal by flight may occur, but artificial distribution, particularly of larvae in the crowns and tops of vegetables, is the chief method of spread. Remedial measures consist of cultivation of the ground, especially while the pupae are most numerous, usually in late March or early April, crop rotation, the use of trap-crops, especially potatoes, which are a preferred food and can be sprayed with acid lead arsenate about 1st May, and also spraying and dusting and the use of poison baits. Contact sprays that have given good results on such crops as spinach, turnips and other vegetables for which arsenicals cannot be used, are a 2 per cent. emulsion of a light, highly refined white oil with nicotine sulphate, 1 : 800 ; and a pyrethrum spray, using 5 lb. to 100 U.S. gals. of water. A number of poison baits have been tried and are enumerated, with the results obtained with each. None has the advantage of being extremely attractive or of attracting the weevils from a good distance ; the best is commercially prepared dried apple bait, finely ground and mixed with sodium fluosilicate. This has resulted in a mortality of more than 90 per cent. in 48 hours in cages containing preferred food-plants. A mixture of 1 part sugar and 1 part calcium arsenate to 6 parts of bran gave about 70 per cent. mortality. Such baits should be applied at the rate of about 75 lb. to the acre about 1st May.

Holdaway (F. G.). **Economic Entomology in the United States.**—*J. Council Sci. Ind. Res.*, i, no. 5, pp. 275–284. Melbourne, August 1928.

This is an abbreviated report of a tour made with the object of studying the major problems concerning exotic insects introduced from other countries into America. Though it is considered probable that the establishment of a natural balance by the introduction of natural enemies of such pests will never be completely attained, this result is an ideal towards which all energies should be directed. It is remarked that although *Porthetria dispar*, L. (gipsy moth) has been present in the United States for 60 years and has been attacked by biological methods for the last 20 years, it still requires an army of workers to keep it in check. The importance of crop rotation and of the inter-relation of the pastoral and agricultural industries with a view to keeping down insect pests is gradually being realised.

Entomology.—*37th & 38th Ann. Reps. Alabama Agric. Expt. Sta., 1925–26, 1926–27*, pp. 21–22 & 23–24. Auburn, Ala. [1926 & 1927.]

Studies by J. M. Robinson on the control of the cotton boll weevil [*Anthonomus grandis*, Boh.] with calcium arsenate dust were continued

[*R.A.E.*, A, xiv, 491]. On heavy red clay soil two series of plots were used, one on old ground and the other on newly cleared ground. Five applications of dust were made, one was washed off within 24 hours, and the fifth, according to the infestation record, was unnecessary. The gains were 90 lb. of seed cotton on the old ground and 150 lb. on the newly cleared area, but these were not sufficient to make dusting profitable. On "black belt" clay nine applications of dust were made throughout the season, three of which were washed off within 24 hours. The gain was 300 lb. seed cotton per acre on the dusted plots. On sandy loam plots the tests were carried out in collaboration with M. J. Funchess to determine the effect of dusting on plots of cotton fertilised at different rates. The results show profitable increases in yield with increased fertilisation up to 1,500 lb. per acre on both dusted and undusted plots. Weevil infestation reached 13 per cent. on 27th August. Three applications of calcium arsenate were made at intervals of 5 days. The gain due to dusting varied from minus 12 lb. of seed cotton on the unfertilised plots to 204 lb. on the plot receiving 500 lb. of fertiliser and 420 lb. on the plot receiving 1,500 lb. of fertiliser. The average results for the three years of the experiment show that the increase in yield from dusting has been dependent on the rate of fertilisation, and that poisoning for weevil control is not profitable unless other conditions are favourable for the production of a good crop.

The life-history of *Diabrotica balteata*, Lec. (belted bean beetle) was studied by J. M. Robinson. The average incubation period lasted 3·8 days, the larval period 15 days and the pre-pupal period 3 days. The pupal period of the only adult that emerged out of the 39 larvae used lasted 8 days.

The southern corn root worm [*D. duodecimpunctata*, F.] was reared by F. S. Arant, who caught 49 adults between 22nd June 1926 and 24th January 1927. Fifty-one eggs were obtained on 1st August, and four adults had emerged by 1st September. The greatest damage to maize was caused by larvae from 8 to 15 days old. Apparently there is no period of complete hibernation, since adults were active on warm days and inactive on cold days throughout the winter. Calcium arsenate is very effective against the adults.

According to H. G. Good, who caught 129 adults of *Cydia* (*Laspeyresia*) *molesta*, Busck (Oriental fruit moth) in various sweetened baits, there are four distinct generations in the year; these occur in early May, the middle of June, late July and early September.

GROSSMAN (E. F.). **Resumption of Egg-laying by hibernated Cotton Boll Weevils** (*Anthonomus grandis*, **Boh.**).—*Florida Ent.*, xii, no. 3, pp. 33–38, 3 refs. Gainesville, Fla., September 1928.

In view of the widespread belief that *Anthonomus grandis*, Boh. (cotton boll weevil) does not oviposit when only fed on the leaves of cotton, as the nutritive elements required for the development of the eggs are only found in the squares, experiments were made and are here described. In order to be sure that the weevils used had not previously fed on squares, individuals emerging from hibernation were chosen. There was a marked difference in the egg-laying activities of females fed on lower (fully developed) and terminal (growing) leaves and comparatively little difference in the activities of those fed on

terminal leaves or squares. The terminal leaves and squares were analysed for a comparison of ether extracts, total nitrogen and carbohydrate content, and the results indicate that no great significance can be attached to the chemical differences with regard to egg-laying. Weevils fed on the lower leaves and then on squares deposited their first eggs 4 days after feeding on the latter, and this was the time required by weevils feeding on squares without a previous diet of leaves. Weevils first fed on terminal leaves deposited their first eggs within 24 hours after feeding on squares, so that it may be assumed that if any vitamin is in question, it occurs both in the terminal leaves and the squares. It is suggested that egg-laying depends chiefly on concentration of diet. Fully grown leaves apparently meet the requirements for life but not for oviposition, while growing leaves appear not only to sustain life, but also to stimulate egg-laying by supplying the necessary food concentration. The question of oviposition is important from the point of view of poisoning the weevils when they emerge from hibernation. If it is realised that the weevils feeding on the cotton buds prior to the appearance of squares will lay their eggs on the latter as soon as they appear, early poisoning will be rigorously followed, but if it is believed that they must first feed on squares, poisoning may be delayed long enough for the hibernated weevils to establish the next generation.

The Velvet Bean Caterpillar, a Peanut Pest in the Everglades.—*Florida Ent.*, xii, no. 3, pp. 39–40. Gainesville, Fla., September 1928.

Anticarsia gemmatalis, Hb. (velvet bean caterpillar) is known to feed on peanuts, but only when they are planted adjacent to velvet beans [*Stizolobium*]. In the Everglades, however, some plantations of peanuts, one comprising 150 acres, were severely attacked, and the moths were observed to oviposit on the plants. With the exception of a few very small patches of velvet beans, the hitherto known foodplants of *A. gemmatalis* [*R.A.E.*, A, xv, 540] seem to be entirely absent from the Everglades, so that the moths are forced to lay their eggs on the only available plant. The larvae were unusually free from parasites, and only about 1 per cent. of the pupae were parasitised by a Tachinid fly. Predators, especially the Carabid, *Calosoma sayi*, Dej., were abundant.

An Outbreak of the Semi-tropical Army Worm.—*Florida Ent.*, xii, no. 3, p. 40. Gainesville, Fla., September 1928.

During the summer of 1928 an unusual outbreak of *Xylomyges cridania*, Cram. (semi-tropical army-worm) occurred in the Everglades. Water hemp (*Acnida cannabina*) was practically defoliated and many grasses, cowpeas, etc., were infested. Later in the season sweet potatoes and especially coffeeweed (*Glottidium versicarium*) were attacked. Where the infested cover crop of cowpeas was cut down, the larvae migrated to young *Citrus* trees and fed on the leaves. Tachinid and Ichneumonid parasites were active, parasitism in some cases reaching 90 per cent. A number of pupae were destroyed by *Calosoma sayi*, Dej.

Good results were obtained against the larvae with poison bran baits.

Effect of the Hurricane on the Abundance of some Insects.—*Florida Ent.*, xii, no. 3, pp. 40–41. Gainesville, Fla., September 1928.

According to observations made by W. L. Thompson at Lake Alfred, Florida, both *Aphis pomi*, DeG. (*spiraecola*, Patch) and its various natural enemies, which included the fungus, *Empusa freseni*, and a number of predacious Coccinellids, were greatly reduced after a hurricane in August. Predacious Syrphid larvae suffered even more severely than the Aphids. *Tetranychus sexmaculatus*, Riley, and *Phyllocoptes oleivorus*, Ashm. (rust mite) were also much less numerous.

Dietz (H. F.). **The Status of our Knowledge of the Iris Borer, *Macronoctua onusta*, Grote.**—*Amer. Iris Soc. Bull.*, xxvi, pp. 20–24, 1928. (Abstract in *Expt. Sta. Rec.*, lix, no. 6, pp. 557–558. Washington, D.C., 1928.)

Macronoctua onusta, Grote, is the most destructive pest of iris in Indiana, particularly in town gardens. When ovipositing, the moths are negatively phototropic, selecting heavy and sheltered clumps for the deposition of their eggs. They are most active in twilight or on dull days, and are somewhat attracted to artificial light. Cage and field observations during three seasons show that the moths emerge between the middle of September and the beginning of November. The eggs, all of which are supposed to be deposited in the autumn, are laid in the folds of iris leaves, or sometimes in other leaves in proximity to iris, from the ground level up to 6 inches above it. Hatching occurs in April or May. The young larvae wander over the foliage making small holes indiscriminately, and some of them tunnel into the tissues of the leaves and act as leaf miners for a few days. Within 24 hours some of the larvae enter the lower sheath-like parts of the leaves, where they remain from 6 to 8 weeks, finally eating their way down to the rhizomes, which they often reduce to mere shells by tunnelling. Infestations of *M. onusta*, only one generation of which is believed to occur each year in Indiana, have hitherto been invariably followed by infections of bacterial rot due to *Bacillus carotovorus*, which often kills the plants. A list, based on definite records, is given of the chief species and varieties of *Iris* subject to attack in Indiana. Most of the eggs laid in the preferred dried outer leaves of the plants may be removed by picking off all dead foliage and débris from around the plants in late autumn and early spring. Three or four applications of an arsenical spray, made at weekly intervals from the time when growth began until the eggs of *M. onusta* had hatched, gave 90–95 per cent. control in 1924 and 1925. Care should be taken that an excess of spray does not collect in the flower and leaf sheaths. Two parasites, *Apanteles militaris*, Walsh, and *Amblyteles jucundus*, Brullé, have been reared from larvae of *M. onusta* at Indianapolis.

Hoerner (J. L.) & Gillette (C.P.). **The Potato Flea Beetle.**—*Bull. Colorado Agric. Expt. Sta.*, no. 337, 20 pp., 2 pls., 3 figs., 16 refs. Fort Collins, Colo., March 1928.

Epitrix cucumeris, Harr., has been causing annual losses, often amounting to £21,000, to the potato industry in Colorado since 1904.

The adults hibernate from mid-October to late May or early June at a depth of 3–5 inches in the soil, and piles of old potato vines attract large numbers. In spring the foliage of many cultivated plants and weeds, preferably Solanaceae, are attacked, but the beetles soon migrate to potato. Small plants may be killed.

The main migration occurred in 1927 from 14th to 25th June. Eggs are deposited singly from early June to early August at a depth of ½–2 ins. in moist soil and about ⅜ in. from the plant, about 108 being the average number laid by each female. Moisture appears necessary both for oviposition and hatching, the incubation period averaging about 10 days. The larvae feed on the roots and tubers, sometimes girdling the former. On the tubers they cause small outgrowths, furrows and pits; the pits later become filled with corky material. Small tubers may partly outgrow the injury. The larval period averages about 26 days, and the pupal about 10. Pupation occurs in a small cell at a depth of 1½–2 ins. in moist soil. Mating takes place at all times of the day in the autumn, but rarely in the spring. After hibernation the beetles live about 2 months. In the laboratory a partial second brood, too small to be of importance, was produced. All stages and the methods of rearing are described.

Clean cultivation, the early burning of dead vines and weeds growing along fences and ditches, and crop rotation aid in controlling this pest. Potatoes planted about the middle or latter part of June on the lighter types of well-drained soil are least liable to be injured. Calcium cyanide dust, applied at the rate of 25 lb. to the acre with a hand duster under a 25-ft. canvas canopy, gave about 75 per cent. control, without scorching the foliage. A spray of 3 lb. calcium arsenate, ¾ lb. casein-lime and 100 U.S. gals. water reduced the beetles on a 2-acre plot by 95 per cent. in 11 days. Further applications, if needed, should be made at intervals of 10 days. Small wooden box-traps which are carried in pairs to cover two rows of plants and contain cyanide dust instead of adhesive are figured; over 3,000 beetles were collected by this means on 0·1 acre three hours after another big collection on the same area.

PAYNE (N. M.). **Cold Hardiness in the Japanese Beetle,** *Popillia japonica,* **Newman.**—*Biol. Bull. Mar. Biol. Lab.*, lv, no. 3, pp. 163–179, 4 figs., 12 refs. Woods Hole, Mass., September 1928.

The following is the author's summary: Cold hardiness, both to the intensity factor and to the quantity factor of low temperature, were studied in the second and third instars of *Popillia japonica*, Newm. (Japanese beetle). Brief observations were made on pupae and adults with regard to cold hardiness. Japanese beetle larvae are somewhat periodic in their cold hardiness to the intensity factor of low temperature, less so than the oak borers previously studied [*R.A.E.*, A, xv, 339, 457] and more so than the aquatic insects. Disease incidence, nutritional state, and degree of dehydration are associated with cold hardiness to the intensity factor of low temperature. Development of cold hardiness to the quantity factor of low temperature is associated with loss of cold hardiness to the intensity factor except in extremely dehydrated individuals. Marked permeability changes associated with enzyme action occur at the vital temperature minimum.

Ludwig (D.). **Development of Cold Hardiness in the Larva of the Japanese Beetle** (*Popillia japonica* **Newm.**). —*Ecology*, ix, no. 3, pp. 303–306, 1 fig., 3 refs. Brooklyn, N.Y., July 1928.

The larval life of *Popillia japonica*, Newm., consists of three instars, the second and third of which, in the neighbourhood of Philadelphia, are the normal hibernating stages, though occasionally a few larvae of the first instar are obtained during the winter and early spring. Laboratory observations were made on the quantity factor of cold hardiness [*R.A.E.*, A, xv, 457] in this insect. First instar larvae exposed to 10° C. [50° F.] on hatching survived for 14–18·4 days, developing more resistance to cold as they became older. During the period of preparation for the first moult, they became more susceptible to cold, the resistance reaching a minimum again in larvae kept at 25° C. [77° F.] for 20 days, just after the first moult, and immediately beginning to increase with the growth of the second instar, the full-grown second instar larva being very resistant, since it is able to pass the winter under field conditions.

Since all larvae found during the winter months in field surveys are in instars that are shown experimentally to be resistant, it is probable that any larvae present at the beginning of cold weather in the less resistant stages were killed. The quantitative differences in the time of survival of larvae in the field and under experimental conditions are probably influenced very largely by the difference in food.

Robinson (W.). **Response and Adaptation of Insects to external Stimuli.**—*Ann. Ent. Soc. Amer.*, xxi, no. 3, pp. 407–417, 5 graphs. Columbus, Ohio, September 1928.

The influence of the hydrophilic colloids present in the tissues upon the physiology of response and adjustment in an organism has been considered. In some recently described experiments [*R.A.E.*, A, xvi, 504], different species of insects were observed to gain or lose in colloidally bound water in direct proportion to their winter hardiness, as the temperature was lowered. The force with which bound water is held by the colloidal particles (amounting to several hundred or even thousand atmospheres) may serve largely to prevent the loss of protoplasmic water in frost-hardy species during freezing.

Determinations were also made of the total, free and bound water content of various insects that live on foods differing greatly in their water content. It was found that those species that live on comparatively dry food and have a small water content hold a large percentage of it in the bound form, where it is secure against the forces of desiccation. For instance, *Calandra* (*Sitophilus*) *granaria*, L., which only contains 46 per cent. of total water, has actually 50 per cent. of it in the bound form. *C. oryzae*, L., with 48 per cent. total water, has 35 per cent. of it bound. *Cyllene robiniae*, Forst. (locust borer) has 20 per cent. of its 58 per cent. total water in the bound form. A reverse colloidal activity occurs with species that live on food containing a high percentage of water, only from 9 to 3 per cent. of a total water content of from 59 to 92 per cent. being in the bound form. Among those in the latter category are army-worms, cutworms, *Pieris rapae*, L., and *Leptinotarsa decemlineata*, Say.

Peterson (A.) & Haeussler (G. J.), U.S. Bur. Ent. **Response of the Oriental Peach Moth and Codling Moth to colored Lights.**—*Ann. Ent. Soc. Amer.*, xxi, no. 3, pp. 353–375, 4 pls., 9 refs. Columbus, Ohio, September 1928.

This paper is concerned with experimental studies on the phototropism of *Cydia* (*Laspeyresia*) *molesta*, Busck (Oriental peach moth) and *C.* (*L.*) *pomonella*, L. (codling moth). An apparatus containing 4 compartments which may be separately illuminated is described.

The following is taken from the authors' summary. There is an approximately equal distribution of the adults of both species in the compartments when these are uniformly illuminated with white lights ; with bulbs varying in strength between 10 and 100 watts, the strongest light attracts the most moths. When these insects are given the choice of coloured lights of approximately equal ratios of intensities, they are nearly all attracted to blue and violet, the latter being preferred. Purple ultra lights, however, are the most attractive. Few or no adults go to red light. Orange, yellow, and green that is devoid of blue rays, are also unattractive when tested with bluish lights. *C. pomonella* appears to be somewhat more positively phototropic to blue and violet lights than *C. molesta*. The latter, however, is probably able to see ultra-violet light. The response of males and females of both species to coloured lights seems to be similar.

When a weaker or less attractive coloured light is placed at a right angle to a stronger or more attractive one, more moths go to the weaker light than when such light is situated opposite the stronger.

Very few Oriental peach moths come to ordinary white or artificial daylight electric lights in the orchard, and traps with these have for a few seasons proved of no value in controlling this insect.

Balduf (W. V.). **Observations on the Buffalo Tree Hopper,** *Ceresa bubalus*, **Fabr. (Membracidae, Homoptera), and the Bionomics of an Egg Parasite,** *Polynema striaticorne*, **Girault (Mymaridae, Hymenoptera).**—*Ann. Ent. Soc. Amer.*, xxi, no. 3, pp. 419–435, 8 figs., 12 refs. Columbus, Ohio, September 1928.

Notes are given on the bionomics of *Ceresa bubalus*, F. (buffalo tree-hopper) in Illinois and Ohio [*cf. R.A.E.*, A, xvi, 569]. In these localities damage to elm was common.

Polynema striaticorne, Gir., everywhere recorded as a parasite of Membracids, was bred from eggs of *C. bubalus* on elm in 1927. Descriptions of all stages and notes on the habits of the adult are given. In the cages mating occurred during the whole summer and was first noticed on 22nd April, oviposition being first observed on 9th May. In the field most of the hopper nymphs and adult parasites had emerged by 26th May, the latter being much less numerous during June. Eggs laid by these adults were first found on 26th May. The development of the second generation apparently took place between about 15th May and 25th August. Some eggs of *C. bubalus* had not hatched as late as 30th June, and in one instance a parasitic larva in the first instar was discovered in the centre of a well advanced embryo. The eggs of the second generation are deposited in the newly laid ones of the tree-hopper, the resulting larvae, pupae and adults being found

between 28th September and 18th October. The progeny of this third generation hibernate as larvae in the first instar in the eggs of their host.

Of the 1,351 eggs examined during the season, 433, or 31 per cent., contained parasites. Eggs that have previously harboured parasites may be recognised by the blackened membrane of the shell.

Holloway (T. E.), Haley (W. E.) & Ingram (J. W.). **The Application of Sodium Fluosilicate by Airplane in an Attempt to Control the Sugar-cane Moth Borer.**—*Circ. U.S. Dept. Agric.*, no. 45, 7 pp. Washington, D.C., October 1928.

Since sodium fluosilicate applied by aeroplane seemed to give satisfactory results against *Diatraea saccharalis*, F. (sugar-cane moth borer) in Louisiana [*R.A.E.*, A, xv, 440], similar experiments have been carried out by the U.S. Bureau of Entomology.

The following is taken from the authors' summary. Five thousand acres of sugar-cane were dusted by aeroplane from one to three times with two different brands of sodium fluosilicate. An apparent death rate of 28·2 per cent. of borers was observed, mostly among small ones, but this was partly offset by the natural mortality of 8·6 per cent., giving as a result of the poison a net kill of 19·6 per cent. Thirteen experiments, conducted at various places, failed to indicate control, probably owing to the low percentage of kill and the high rate of reproduction of the moth borer. The sugar-cane was injured by the application of sodium fluosilicate, and estimates by experienced observers indicate that the injury was serious.

Lowry (P. R.). **The Stalk Borer. Life History in New Hampshire, 1925-1926.**—*Tech. Bull. New Hampshire Agric. Expt. Sta.*, no. 34, 23 pp., 1 chart, 24 refs. Durham, N.H., June 1927. [Recd. 1928.]

Papaipema nitela, Gn. (*nebris*, Gn.), though not a pest of major importance in New Hampshire, causes considerable loss in vegetable and flower gardens. The methods used in rearing are discussed, and the various stages are described. A list is given of 28 food-plants that have been found infested and of the 53 additional ones cited in the literature. The injury caused is described in detail; the larvae usually bore into the stalks, causing the tops of the plants to wither and die or to break off altogether. There is one generation a year, and the winter is passed in the egg stage. In the laboratory hatching occurred towards the end of May and beginning of June. The date of hatching is not controlled by the date of oviposition, since both the earliest and latest laid eggs may hatch on the same day. The larval period for two years averaged 81·7 days. Pupation takes place in the stalks in August and the first part of September and the pupal stage lasts from 25 to 38 days. The adults emerge in September and the first few days of October. The pre-oviposition period averaged 1·6 days and the oviposition period 10·5. Dead grass was preferred, and each female laid 80–895 eggs (depositing on an average 15·7 masses each consisting of 22·5 eggs).

During the three years 1924–27, larval parasitism varied from 10 to 28·5 per cent. The Tachinid, *Masicera senilis*, Mg., was the commonest parasite. The adults of this fly emerged from 23rd July to 31st

August, the pupal period of the few individuals observed lasting 12–16 days. The Ichneumonid, *Sagaritis oxylus*, Cress., and an unidentified parasite, possibly *Microplitis gortynae*, Riley, were also observed. Two thread worms (*Mermis* ?) caused the death of one larva. A list of 7 other parasites is cited from the literature, while the ant, *Solenopsis molesta*, Say, has been reported as predacious on the larvae in Kansas.

If attack by *P. nitela* is noticed before the top of the plant wilts, about half a teaspoonful of carbon bisulphide or chloroform should be injected with a medicine dropper and the hole tightly plugged with putty or clay. Otherwise the borers should be extracted from the stalk and killed, or the tops may be cut off below the entrance holes and burned immediately. Infestation may be prevented by ploughing, or closely mowing, grasslands or weed areas round cultivated fields and gardens from about the middle of August to the first week of September to prevent oviposition. Mowing or ploughing infested weeds or grasses while the larvae are active is more likely to increase the infestation in cultivated crops. Burning weeds and grasses from 1st November to 1st April will destroy the eggs and ploughing would probably have the same effect. When *P. nitela* is known to be present, especially prized plants may be protected by a collar about 4 inches high round the base of the plant, set a little way into the soil, with a band of adhesive entirely round the outside of the collar.

Instrucciones para combatir el picudo del algodón, *Anthonomus grandis*, **el picudo de la papa,** *Epicaerus cognatus*, **la hormiga arriera,** *Atta fervens*. [Instructions for combating the Cotton Boll Weevil, the Potato Weevil, and the Leaf-cutting Ant.]—*Bol. Divulg. Oficina Defensa agríc. Sec. Agric. Fom. México*, nos. 5–7; 6 pp., 3 figs.; 6 pp., 5 figs.; 15 pp., 10 figs. San Jacinto, D.F., 1928.

These are popular pamphlets on the bionomics and control of the insects mentioned in the title, all of which are serious pests in Mexico.

[Skeete (C. C.).] **Entomological Work.**—*Rep. Dept. Agric. Barbados 1926–27*, pp. 14–15. [Bridgetown] 1928.

Diaprepes abbreviatus, L. (root borer) and *Lachnosterna smithi*, Arrow (brown hardback) continue to attack sugar-cane. The larvae of the latter are parasitised by *Tiphia parallela*, Smith, which feeds on secretions on the leaves of *Cordia interrupta* and on scale-infested guava. These plants should therefore be planted and encouraged in every suitable locality. The grey king bird, *Tyrannus dominicensis*, which preys on this parasite and other useful insects, should be destroyed. The mongoose has greatly reduced the toad, *Bufo agua*, which at one time was so useful in destroying root-borer beetles. Several individuals of *Ipobracon grenadensis*, Ashm., and *Microdus* sp., parasites of the larvae of *Diatraea saccharalis*, F., have been imported from Argentina.

Parasierola nigrifemur, Ashm., a parasite of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., appeared during the season, but so far it has failed to control its host. There was a severe outbreak of *Alabama argillacea*, Hb., on cotton.

Bondar (G.). *Prodecatoma spermophaga*, **Costa Lima, praga do feijão hollandez.** [*P. spermophaga*, a Pest of *Canavalia ensiformis*.]—*Correio agric.*, vi, no. 6–7, pp. 122–123, 1 fig. Bahia, 1928.

The extensive cultivation in Bahia of *Canavalia ensiformis* is suggested, especially as it is not attacked by the ant [*Atta sexdens*, L.]. It is, however, infested by the Eurytomid, *Prodecatoma spermophaga*, Costa Lima, which oviposits in the pods. Before planting *C. ensiformis*, all allied wild leguminous plants should be cleared from the immediate neighbourhood.

Bondar (G.). **As maniçobas e diversas lavouras no norte da Bahia.** [Cassava and other Crops in the North of Bahia.]—*Correio agric.*, vi, no. 6–7, pp. 133–137. Bahia, 1928.

The insect pests mentioned in this paper include the Tingid, *Gargaphia torrezi*, Costa Lima, attacking beans (*Phaseolus* spp.); the mite, *Tetranychus gloveri*, Banks, on tomato; the Coccids, *Aspidiotus rapax*, Comst., common on orange, lemon, guava, rose, etc., *A. destructor*, Sign., on *Anona*, and *Pseudaonidia trilobitiformis*, Green, on orange and mango; *Retithrips aegyptiacus*, Marchal, on rose and vine; and *Heliothrips haemorrhoidalis*, Bch., on orange and vine. The pink bollworm [*Platyedra gossypiella*, Saund.] has caused cotton growing to be abandoned.

Bondar (G.). **Uma nova especie de Hymenoptero nas sementes de anonacea.** [A new Species of Hymenopteron in the Seeds of an Anonaceous Plant.]—*Bol. biol.*, 1928, no. 13, pp. 83–84. S. Paulo, 22nd September 1928.

The Eurytomid, *Prodecatoma limai*, sp. n., is described from the seeds of an Anonaceous plant in Bahia, Brazil.

de Sousa Geribello (C.). **A broca do café.** [The Coffee Borer.]—*Rev. Soc. rur. brasil.*, viii, no. 100, pp. 270–271, 2 figs. S. Paulo, September 1928.

This article contains suggestions for the financial organisation of work against *Stephanoderes hampei*, Ferr. (coffee berry borer) in S. Paulo, Brazil.

Bondar (G.). **A broca dos tomateiros,** *Phyrdenus divergens*, **Champ.** [The Tomato Borer, *P. divergens*, Germ.]—*Correio agric.*, vi, no. 8, pp. 155–156. Bahia, August 1928.

Phyrdenus divergens, Germ., is a serious pest of tomatos in Brazil [*R.A.E.*, A, xiii, 198].

It is believed that in Bahia *Solanum paniculatum* is the chief plant on which the weevil breeds and from which it passes to other Solanaceae, including tomato. Only the adults feed on tobacco and *S. dulcamara*. Before planting tomatos, it is advisable to clear other Solanaceae from the vicinity. Infested tomatos should be sprayed with Paris green before the fruits are formed.

[**Prickly Pear Expenditure.**]—*Commonw. Australia Debates*, no. 51, extract 1 p. [Canberra] 1928.

The Prime Minister stated in answer to a question that the area under prickly pear [*Opuntia*] in Queensland in 1908, 1918 and 1928 was 12,000,000, 20,000,000 and 50,000,000 acres respectively, and in New South Wales for the same years 2,000,000, 2,200,000 and 8,500,000. The figures for 1928 probably include more lightly infested areas than those of the previous years. No data are available for the other States, but the total infestation is very slight.

The chief research work is being undertaken by the Commonwealth Prickly Pear Board. As from the beginning of the present financial year, the annual vote of the Board will be increased from £12,000 to £18,000, made up of contributions of £9,000 from the Commonwealth and £4,500 each from the States of Queensland and New South Wales. Several species of insects that kill prickly pear have been established in such large numbers that already the annual increase, estimated some years ago at 1,000,000 acres a year, is claimed to have been stopped, and the larger contributions are intended to intensify the operations of the Board before local parasites or predators, unusual climatic conditions, outbreaks of diseases, etc., combine to exercise a nullifying effect on the work of the insects that have already been introduced.

Gurney (W. B.). **Grasshoppers. Departmental Recommendations for Control.**—*Agric. Gaz. N.S.W.*, xxxix, pt. 9, pp. 645–652, 6 figs. Sydney, September 1928.

This paper is a revision of one already noticed [*R.A.E.*, A, xiii, 640], the additions including some modifications in the poison baits recommended.

Levick (G. T.). **Household Insect Pests.**—*J. Dept. Agric. Victoria*, xxvi, pt. 8, pp. 453–458, 5 figs. Melbourne, August 1928.

Household pests occurring in Victoria include two species of termites, *Porotermes adamsoni*, Frogg., and *Coptotermes acinaciformis*, Frogg., which attack woodwork in houses. Infestations generally originate by a nest being started at ground level in the neighbourhood of a house. When the workers from this nest are bred, they begin to attack the adjacent timbers, running tunnels up the inside of the wood and frequently penetrating considerable distances through the building. As they never come to the surface, the first indication of their presence may be the collapse of a part of the building. The fact that the termites soon die when their connection with the ground is severed is made use of in their control. In Victoria this connection is often effected through the wooden stumps on which the building is erected, and these should be removed and replaced with new timbers, that have been soaked in creosote and kerosene in equal parts. Nests should be removed and burnt, and the surrounding soil soaked with the kerosene-creosote mixture. Defective timbers in the building should then be removed and replaced with treated ones. Where infestation is known to be severe, no timber should be placed in contact with the ground; brick concrete or stone should be used instead. Woods vary somewhat in resistance to termites, Murray pine [*Callitris*] being the only variety practically immune.

Brief notes are given on the appearance, bionomics and control of other household pests, including *Anthrenus varius*, F. (carpet beetle), *Lepisma saccharina*, L. (silverfish) and Psocids (booklice).

LEVICK (G. T.). **Codling Moth Control. Experiments at Harcourt.**—*J. Dept. Agric. Victoria*, xxvi, pt. 8, pp. 459–462. Melbourne, August 1928.

An account is given of experiments in the control of *Cydia pomonella*, L., carried out in Victoria in 1926–27, with the objects of reducing the amount of arsenical residue on sprayed apples by combining ovicidal materials with lead arsenate; timing the application of ordinary arsenical sprays so that each will have its maximum effect and thus reduce the number of applications necessary; and discovering the most effective strength at which to apply lead arsenate. The only satisfactory degree of control was obtained with two calyx sprays of lead arsenate (on 17th and 24th October) followed by 3 applications (in November, December and January) of Volck summer spraying oil, 1 : 32. The arsenical residue in this case was slightly above tolerance. Four applications of lead arsenate, 5 lb. in 80 gals., gave a result well under the limits laid down by the Imperial authorities. This indicates that the oil prevents the lead arsenate from being washed off. Where the arsenic was applied at greater strengths than 5 lb. to 80 gals., the amount of residue was much greater, without any perceptible advantage being secured in the control of the moth.

SUMMERVILLE (W. A. T.). **Mealy Bug attacking Paspalum Grass in the Cooray District.**—*Queensland Agric. J.*, xxx, pt. 3, pp. 201–209, 1 pl. Brisbane, 1st September 1928.

During 1926 an unidentified mealybug was observed attacking *Paspalum dilatatum* in the Cooray District, many acres of grass on the pasture lands being destroyed. It spread rapidly, and in 1927 the heaviest damage occurred at a distance of 5 miles from the original infestation. In all cases the outbreaks were observed in isolated patches of a few acres, and were confined to the northern slopes of ridges, protected from the strong south-east winds and more exposed to the sun. The injury is described. The insects never penetrate the surface of the soil and are usually found six to thirty or more clustered together as near the base of the leaf stalk as possible. The attack is always most severe in thick matted grass. The Coccid is disseminated largely by the wind. Rhodes grass (*Chloris gayana*) growing in badly infested fields was left untouched, but experiments showed that the mealybug can thrive and reproduce on this grass, and can also survive for many weeks and probably breed on *Pennisetum longistylum*. *Paspalum* is, however, much preferred. No dicotyledons were found to be attacked. All stages of the insect are described. The larvae are deposited in a single investing membrane, which is ruptured almost immediately. After a period of one to three days of activity during which they disperse over the plant, the larvae settle down to feed and rarely move any distance. The females produce an average of 250 larvae during a period of 3–7 days, and may survive for more than two weeks afterwards. The average life-cycle lasts 70·4 days. Reproduction can be parthenogenetic. Brief descriptions are given of the two natural enemies

observed, namely, the Coccinellid, *Cryptolaemus montrouzieri*, Muls., and the Chalcid, *Leptomastix guttatipennis*, Gir.

Chemical measures of control are considered impracticable. In all cases where injury was noted, the pastures varied from ten to fifteen years in age, and since *Paspalum* has a tendency to become root-bound and the soil is not well-drained, the plants are weakened and rendered more susceptible to attack. Ploughing has been found to be the quickest method of renovating old root-bound *Paspalum* pastures, and infested fields should therefore be burned and then ploughed to a depth of about 4 inches. Where small areas are affected they should be ploughed as soon as possible to prevent the infestation from spreading, but in the case of larger areas ploughing in winter or early spring should give the best results.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Ann. Rep. Guam Agric. Expt. Sta. 1926*, pp. 15–19, 1 fig. Washington, D.C., 1928.

Emergency control methods carried out in 1924 against *Aspidiotus destructor*, Sign., on coconut, which consisted of cutting and burning the infested leaves in the areas more severely attacked, while temporarily checking the scale, killed large numbers of beneficial insects that would have later effected control. Parasites and predators, which once more gained the ascendency after the July rains in 1925, had greatly reduced the scale by January 1926, and although an increase occurred during the dry season, the pest was less numerous and less injurious than previously, and is now always found attended by one or more of its natural enemies. *Cryptogonus orbiculus* var. *nigripennis*, Wse., has been found to be the most important enemy of *A. destructor* in Guam. The internal parasites mentioned in the previous report [*R.A.E.*, A, xv, 417] have now been identified by Timberlake as *Aphelinus chrysomphali*, Mercet, and *Aspidiotiphagus agilior*, Berl., the former attacking the female scale and the latter the male, which is rarely seen in the field in consequence of the efforts of this parasite. The value of *A. agilior*, however, is much reduced by the apparent ability of the female scale to reproduce parthenogenetically. An entomogenous fungus (*Cephalosporium lecanii*), which was discovered attacking the scale, has been propagated and distributed on *A. destructor* and *Asterolecanium bambusae*, Boisd. The reduction of the scale in the wet season is due, in addition to rain, to the strong winds generally prevailing then, whilst, on the other hand, all stages of the scale are intolerant of prolonged tropical sunshine, so that the central upright leaves, which are more exposed to the light, remain uninfested. Although attempts to import the Coccinellid, *Lindorus lopanthae*, Blaisd., from California have failed, it was successfully introduced from Hawaii, but when placed on an infested tree in company with *C. orbiculus*, it failed to establish itself.

Other imported beneficial insects include: *Novius cardinalis*, Muls., which practically exterminated the cottony cushion scale [*Icerya purchasi*, Mask.]; *Cryptolaemus montrouzieri*, Muls., which was bred for distribution against various Coccids; and the Tachinid, *Ceromasia sphenophori*, Vill., which is parasitic on *Rhabdocnemis obscura*, Boisd., all these being from Hawaii.

Pyrausta nubilalis, Hb. (European corn borer) again caused considerable damage to the maize crop, and two importations of *Pimpla*

(*Exeristes*) *roborator*, F., from the United States, have failed to control it.

Insects sent in for identification, not previously recorded in Guam, include: *Phthorimaea operculella*, Zell. (potato tuber moth), *Ceroplastes floridensis*, Comst. (Florida wax scale), which was found on mango and *Cassia florida*; and *Tortrix* (*Archips*) *rosaceana*, Harr. (oblique-banded leaf-roller), which was observed infesting *Pithecolobium*.

Tanganyika Territory: Plant Pest and Disease Ordinance, 1921. Plant Pest and Disease (Coffee) Regulations, 1928.—*Govt. Notice*, no. 139, 4 pp. Dar-es-Salaam, 25th September 1928.

These regulations govern the packing, movement and treatment of coffee plants, berries and beans, to prevent the spread of any pest or disease of coffee in Tanganyika Territory.

Anderson (T. J.). **Annual Report of the Entomologist, 1927.**—*Ann. Rep. Dept. Agric. Kenya 1927*, pp. 208–219. Nairobi, 1928.

As a result of serious damage to maize by *Busseola fusca*, Fuller (stalk-borer) in Kenya, a campaign to be undertaken in 1928, including the restriction of maize planting to the period 15th February–10th June, was planned. It seems unlikely that the borer will be eradicated, since conditions are particularly favourable to it. Insects recorded on wheat include the larvae of the Noctuid, *Phytometra orichalcea*, F., on developing grains.

In the remainder of the report by T. W. Kirkpatrick, several small outbreaks of *Anthores leuconotus*, Pasc. (white coffee borer) are recorded. Its eggs are laid at the base of the coffee tree. The larvae bore downwards and eat the bark below the level of the soil, sometimes completely ringing the tree. They then bore into the wood and work upwards, as many as ten being found in one plant. The larval period is somewhat shorter than in Nyasaland [*cf. R.A.E.*, A, xvi, 76]. Affected trees should be destroyed before the larvae are mature, as they seldom recover. Against *Pseudococcus lilacinus*, Ckll. (common coffee mealybug) [*cf.* xvi, 308] a proprietary substance, lypticide, which may be used undiluted or mixed with water (1 : 5), is superior to anything previously suggested for painting the affected parts of the trees. When banding plants with either tar-oil ant repellent or crude castor oil, both grease-proof paper and cotton lint should be liberally used; with the former, strips 30 by 4 ins. would cost only 3*s.* to the acre, locally.

Much damage by *Dysdercus* sp., which appears to be most numerous on cotton growing near wild Malvaceae, would be eliminated by the eradication, or even the partial destruction, of the latter. In view of the prevalence of the seed-bugs, *Oxycarenus hyalinipennis*, Costa, and *O. gossypinus*, Dist., only seed from the earliest picked cotton should be sown. *Platyedra gossypiella*, Saund., was less injurious owing to the presence of its parasite, *Microbracon kirkpatricki*, Wlksn. [xvi, 49.]

Brooks (A. J.). **Rosette Disease Investigations.**—*Ann. Rep. Dept. Agric. Gambia 1927–28*, pp. 11–16. London [1928].

A collection of insects made to determine the carrier of rosette disease of ground-nuts in Gambia, where *Aphis leguminosae*, Theo.,

which transmits the disease in South Africa, does not occur, showed the presence of two new species of Jassids, *Cicadulina* [*arachidis*, China, and *C. similis*, China (*R.A.E.*, A, xvi, 652)], one or both of which may prove to be the vector. The insect carriers, to judge from the appearances of the disease, seem to be most active between the middle of July and the middle of August. Plants affected with rosette disease bear a mass of crinkled, yellow leaves, with shortened internodes, and become stunted in growth. Empty shells are increased up to 55 per cent., while good nuts are reduced to 36 per cent., and in some cases the plants are rendered barren. Infection is undoubtedly carried over from year to year by ground-nuts left in the ground from the previous season. Although this is probably not the only means of infection, all the available evidence goes to show that it is not carried in the seed. The plants are most susceptible during the first few weeks after germination. Rainfall appears to reduce the virulence of the disease, probably by rendering the insect carrier less active, particularly during the early stages of the growth of the plant.

Crops sown early, at the end of June or early in July, during the brief drought that follows the early rains and before the carriers reach their maximum activity, are less susceptible to infection than those sown later. Control at present depends upon the destruction of all plants showing signs of the disease, the destruction of all ground-nuts between growing seasons, and sowing the general crop to avoid, so far as practicable, drought during the first few weeks of growth. Three varieties that have been found to show definite resistance to the disease, both when grown in individual plots and when mixed with seed of susceptible varieties, are being grown in bulk and distributed for general cultivation.

Innes (F. A.). **Notes** [on Termites].—*Ann. Med. & San. Rep. Gambia 1927*, p. 20. London, 1928.

A termite, which has been identified as *C*[*ryptotermes*] *lamanianus*, Sjöst., has destroyed much furniture and woodwork in Bathurst. This termite does not require to have any connection with an earth nest, nor does it need to build tunnels to enable it to live and work.

Cotterell (G. S.). **The Red Banded Cacao Thrips, *Heliothrips rubrocinctus*, Giard.**—*Bull. Dept. Agric. Gold Coast*, no. 13 (Year-Book 1927), pp. 94–99, 1 pl., 7 refs. [Accra] 1928.

An account is given of the bionomics and control of *Heliothrips rubrocinctus*, Giard, which attacks cacao in the Gold Coast [*R.A.E.*, A, xvi, 242]. All stages are briefly described. Damage is caused by the nymphs and adults sucking the lower surface of the leaf or the surface of developing pods. The epidermal cells are broken down, and in severe cases of leaf damage this is followed by general necrosis of the attacked area and subsequent abscission, sometimes resulting in complete defoliation. Attacks occur when humidity is low or irregular, owing to indiscriminate deforestation, when there is an absence of overhead and lateral shade and the plant and soil are exposed to the sun, and when the soil does not retain sufficient water. Abscission followed by die-back may, however, occur as a result of purely physiological conditions, chiefly relating to water-supply, that are unfavourable to the growth of cacao. Since this thrips is not the

sole cause of die-back and is entirely secondary to bad cultural conditions, it may be classed in the Gold Coast as a minor pest. Among the many food-plants recorded are *Cola acuminata*, mango (*Mangifera indica*), guava (*Psidium guayava*), avocado (*Persea gratissima*), *Acalypha* sp. and *Terminalia* sp.

The life-history was studied on the plant in the field in cages consisting of the cover of an entomological pill box with the glass removed and replaced by a double layer of fine cotton gauze. An inside wall of cardboard was made, and the space between the two walls was packed with cotton wool, so that, when the cover was clamped to the under surface of a cacao leaf, no space was left between the leaf veins through which the insects could escape. This proved more or less satisfactory, though some of the thrips did escape. The incubation period was found to average 1–3 days. The eggs are deposited singly on the lower surface of the leaf and also in the pods, and covered with a drop of excrement. The nymphal stage averages 12–13 days, the active feeding period lasting about 7, the pre-pupal stage 3 and the pupal stage 3. The adults examined were all females. Reproduction is parthenogenetic, but it is probable that a few males are produced occasionally. The adults appear to be incapable of long direct flight, their movements consisting chiefly of long hops from leaf to leaf. Direct sunlight is avoided, especially by the nymphs. Cultural methods of control consist of the correction of the conditions favourable to attack. Artificial methods are impracticable in the Gold Coast, but it has been found that the application of a 2 per cent. solution of kaolin or lime acts as a preventive against oviposition.

Cotterell (G. S.). **Minor Pests of Cacao.**—*Bull. Dept. Agric. Gold Coast*, no. 13 (Year-Book 1927), pp. 100–106, 4 pls., 5 refs. [Accra] 1928.

The greater part of the information given in these notes has already been noticed [*R.A.E.*, A, xvi, 242]. A number of undetermined Coccids attack the stems, leaves and pod peduncles of cacao, but are comparatively unimportant. Among those that have been identified are *Stictococcus multispinosus*, Newst., *Ferrisia virgata*, Ckll., and *Aspidiotus* (?) *cyanophylli*, Sign. The Curculionid, *Apoderus flavoebenus*, Thoms., rolls the leaves, but does no economic damage.

Lucky (R. H.). **Un nouveau parasite occasionnel du cotonnier dans la vallée du Niger.**—*Agron. colon.*, xvii, no. 128, pp. 43–45, 1 fig. Paris, August 1928.

A leaf-cutting bee, *Megachile* sp., was observed in the Niger valley in 1925 attacking the foliage of imported cotton (*Gossypium hirsutum*). It appeared to avoid native varieties growing in the same region, but occurred frequently on *Zizyphus* spp.

Théry (A.). **Note sur un Curculionide nuisible aux cultures florales.**—*Bull. Soc. Sci. nat. Maroc*, viii, no. 1–3, p. 15. Rabat, March 1928.

Pantomorus godmani, Crotch, which was found for the first time in Morocco in November 1924 on chrysanthemum, is recorded from

Rabat on the flowers of cultivated *Salvia*, on which it was present in large numbers throughout the autumn, and also on almond. It is now considered to be acclimatised in Morocco, where it is probably widely distributed, though no serious injury has yet been reported. This weevil, the distribution of which is briefly discussed [*R.A.E.* A, x, 541], attacks roses, geraniums and fruit-trees in the United States, the larvae boring into the roots and the adults eating the leaves, flowers and buds

KUWAYAMA (S.). **Notes on *Laspeyresia glycinivorella*, Matsumura, the Soy Bean Pod Borer.**—*J. Coll. Agric. Hokkaido Imp. Univ.*, xix, pt. 5, pp. 261–282, 1 pl., 19 refs. Sapporo, September 1928.

Cydia (*Laspeyresia*) *glycinivorella*, Mats., all stages of which are described, is a serious pest of soy-beans [*Glycine hispida*] in Japan, where it is widely distributed, and also occurs in Korea and South Manchuria. An account is given of its bionomics [*R.A.E.*, A, xiv, 329]. Over 80 per cent. of the seeds, which are attacked just before harvest, have been destroyed in severe infestations. The eggs are usually laid singly on the pods, though as many as 7 have been found in one pod, and are sometimes found on the petioles or stipules. Over 90 per cent. of the pods examined contained only one larval exit hole, though two or three were occasionally found. The adults, which are rather sluggish, are most active in the morning and evening. Males were more often taken in light traps, but females were attracted in larger numbers by baits containing sugar, saké, vinegar and water. Soy-bean appears to be the only food-plant of *C. glycinivorella*, and negative results were secured in endeavours to breed it on related leguminous plants. A list is given of seven other insect pests of soy-beans in Japan, with indications for distinguishing the injury caused by them from that due to the borer. Natural enemies of the latter include two Ichneumonids, *Pimpla* (*Epiurus*) *hakonensis*, Ashm., and *P.* (*E.*) *glycinivorellae*, Uchida, both of which are parasitic on the larva, the Asilid, *Asilus atripes*, Lw., which is predacious on the adult, the ant, *Lasius umbratus mixtus*, Nyl., which destroys full-grown larvae, and two parasitic fungi. Methods of control include the selection of resistant varieties of soy-beans, variation of the period of sowing, planting in alternate rows with cereals, the collection of the moths with nets and the use of baits for them, spraying with nicotine sulphate and soap, or lead arsenate, just before the larvae enter the pods, autumn ploughing, and crop rotation.

ANDREWS (E. A.). **On the Incidence of Insect Pests and Fungus Diseases on Tea at Tocklai.** —*Quart. J. Ind. Tea Ass.*, 1928, pt. 3, pp. 173–177. Calcutta, 1928.

An account is given of observations on the incidence of insects and fungi attacking tea at Tocklai and on the possible effect of different treatments on them. The pests have been recorded at intervals since 1917, 49 observations having been made, but in most cases the number of occurrences was too small to enable reliable conclusions to be drawn. Manuring has no traceable influence on insects and mites. Red spider [*Tetranychus bioculatus*, W.M.] was much more prevalent on bushes that had been so pruned as to leave poor and old wood in the bushes.

Tea aphis [*Toxoptera aurantii*, Boy.], on the other hand, appears to prefer light and air in the bushes and sound flushing shoots. The distribution of leaf-rollers shows no relation to pruning. More red spider occurred on severely plucked bushes, and more leaf-rollers were present on the lightly plucked ones. A plot left smothered with jungle was distinctly less attacked than an adjacent plot in which the jungle was always kept down.

George (C. J.). **South Indian Aphidae.** – *J. & Proc. Asiatic Soc. Bengal*, N.S., xxiii (1927), no. 1, pp. 1–12. Calcutta, July 1928.

This paper is the result of a study of the Aphids of southern India, with special reference to those of Coimbatore. Of the 34 species listed, with references to the literature, those doing serious damage are *Macrosiphum solidaginis*, F., on safflower [*Carthamus*]; *M. sanborni*, Gill., on chrysanthemum; *Myzus persicae*, Sulz., on tobacco and crucifers; *Pentalonia nigronervosa*, Coq., on banana; *Brevicoryne coriandri*, Das, on coriander; *Aphis* (*Rhopalosiphum*) *pseudobrassicae*, Davis, on crucifers; *A.* (*R.*) *avenae*, F., on roots of *Eleusine coracana*; *A. gossypii*, Glov., on malvaceous plants; *A. laburni*, Kalt. (*medicaginis*, Koch), on leguminous crops; *A. malvae*, Koch, on cucurbits; *A. tavaresi*, DelG., on *Citrus*; *A. maidis*, Fitch, on *Sorghum* and maize; *A. odinae*, v.d.G., on mango; and *Eriosoma lanigerum*, Hausm., on apple. *Dilachnus krishni*, sp. n., is described from pear, *Forda orientalis*, sp. n., from *Sorghum*, and *Tetraneura cynodonti coimbatorensis*, subsp. n., from roots of sugar-cane.

All the species of Aphids at Coimbatore apparently breed parthenogenetically throughout the year, and sexual forms have never been observed, possibly owing to the fact that there is no definite winter season. A cool, humid atmosphere ensures abnormal multiplication, whereas dry weather retards reproduction and causes excessive mortality. Scarcity of plant sap caused by severe local attack always tends to produce winged forms that migrate to other plants. With few exceptions Aphids in south India do not thrive unless attended by ants, *Camponotus compressus*, F., *Solenopsis geminata*, F., and *Cremastogaster* sp. being those commonly associated with them.

Hutson (J. C.) & others. **Reports on Insect Pests in Ceylon during 1927.**—15 pp. [in] *Tech. Rep. 1927 Dept. Agric. Ceylon.* Colombo, 1928.

This paper includes the reports of the Entomological Division and the Plant Inspectors on insect pests studied in Ceylon during 1927, much of the information having already been noticed from various sources. Preliminary work in the control of *Aularches miliaris*, L. (spotted locust) was carried out in various districts. Hoppers less than a week old were killed by spraying, under field conditions, with a solution of $\frac{1}{4}$ lb. laundry soap in 2 gals. water, but against those 3–4 weeks old 1 lb. to 6 gals. was necessary. When the insects were 2 months old, the water had to be reduced to 4 gals., and by this time they were too active to be satisfactorily sprayed. Calcium cyanide was only effective against hoppers 2–3 weeks old.

V. D. Meer Mohr (J. C.). **Resultaten van een 3-tal bespuitings- en bestuivingsproeven door het Proefstation genomen in 1928.** [Results of three-fold Spraying and Dusting Experiments made in 1928 by the Deli Experiment Station.]— *Vlugschr. Deli Proefst.*, no. 44, 5 pp. Medan, August 1928.

Experiments were made to test the relative value of dusting alone and spraying followed by dusting against the caterpillar pests of tobacco in Deli, Sumatra. Calcium arsenate and lead arsenate were used for both sprays and dusts. The plots treated with dusts showed 10–14 per cent. less injury by the caterpillars than those on which spraying was followed by dusting, and the plants were not more scorched. Dusting avoids the cost of sprayers, and there is a saving of time of about one-quarter. Its disadvantages are the extra cost of materials, especially when lead arsenate is used, and the trouble of preparing the carrier.

[Bernard (C.).] **Verslag over de werkzaamheden van het Proefstation Midden-Java gedurende het jaar 1927.** [Report on the Work of the Central Java Experiment Station for 1927.]—Typescript, 14 pp. Salatiga, 1928.

Notes are given on the insects recorded in 1927, all of which are of common occurrence in Java. The Coccinellid, *Cryptolaemus* [*montrouzieri*, Muls.] was obtained for breeding with a view to its distribution in 1928 against *Ferrisia* (*Pseudococcus*) *virgata*, Ckll., which seriously injured *Leucaena glauca* and coffee. The work of breeding the parasite [*Prorops nasuta*, Wtstn.] for liberation against the coffee berry borer [*Stephanoderes hampei*, Ferr.] was continued without much success, and it did not appear to have become established where it had been liberated.

Palestine : Bee Diseases Ordinance, no. 26 of 1928.—3 pp. Jerusalem, 22nd August 1928.

Under this ordinance to provide for the protection of bees from disease, inspectors may enter any premises where bees are kept and order destruction or treatment when any infectious or contagious disease is found. No infected bees or apiaries may be moved, nor may any bees or apiary equipment be imported into Palestine, except with a certificate of inspection and freedom from disease.

Suire (J.). **Sur le transport des spores de** *Bacillus larvae* **White par les chenilles de** *Galleria mellonella* **L.**—*Bull. Soc. zool. Fr.*, liii, no. 5, pp. 319–321, 1 ref. Paris, 30th September 1928.

The author does not consider that *Galleria mellonella*, L., is of importance in spreading *Bacillus larvae*, the causal organism of American foulbrood of bees [*R.A.E.*, A, xii, 510]. Clean hives of healthy bees placed near an infested hive were attacked by the disease after 46 days, while healthy colonies placed near an infested hive, from which the diseased bees had been removed, and in which numbers of *G. mellonella* were being bred, remained healthy throughout the whole year during which the experiments were made. The propagation of diseases of bees is, in the author's opinion, accidental. Apart from lack of cleanliness, plundering of a healthy hive by workers of infected colonies would seem to be the only important method of dispersion of various pathogenic micro-organisms.

[Musanov (V. D.).] **Мусанов (В. Д.).** *Galerucella tenella*, **L.** [*In Russian.*]—*List. astrakhan. St. Rast.*, no. 84, 4 pp., 1 fig. Astrakhan, May 1928.

A brief description is given of all stages of *Galerucella tenella*, L., the larvae of which attack strawberry leaves in Astrakhan and considerably reduce the crop. Spraying the plants with a mixture of 1 oz. Paris green and 2 oz. unslaked lime to 6 gals. water is recommended ; a first application should be made directly after the formation of the leaves, a second after the formation of the fruit-buds, and a third after the picking of the fruit. Spraying should be done very carefully so that the poison reaches the lower part of the leaves, where the larvae chiefly occur. The first spray may consist of 1 oz. Paris green to 6 gals. Bordeaux mixture if a fungicide is required. Clean cultivation in the autumn destroys the shelter for the hibernating beetles. As *G. tenella* prefers damp places, these should be avoided when planting strawberries. It is also advisable to transplant the strawberries to fresh beds as far away as possible from infested places, as the beetle does not migrate.

Papers noticed by Title only.

Emerson (A. E.). **Termites of the Belgian Congo and the Cameroon.** —*Bull. Amer. Mus. Nat. Hist.*, lvii, art. 7, pp. 401–574, 19 pls., 79 figs., 24 maps, 15 pp. refs. New York, N.Y., 12th September 1928.

Ozols (E.). **Ichneumoniden aus bekannten Wirtstieren in Lettland.** [Ichneumonids from known Hosts [Coleoptera and Lepidoptera] in Latvia.]—*Konowia*, vii, no. 2, pp. 134–146, 7 figs., 1 pl., 7 refs. Vienna, 1st September 1928.

Bradley (J. C.). **A Revision of the New World Species of** *Trielis*, **a Subgenus of** *Campsomeris* **(Hymenoptera : Scoliidae).**—*Trans. Amer. Ent. Soc.*, liv, no. 3, pp. 195–214, 4 figs. Philadelphia, Pa., September 1928.

Oudemans (A. C.). **Fauna Buruana. Acari.** —*Treubia*, vii, suppl., pt. 2, pp. 37–100, 175 figs. Buitenzorg, November 1928.

Kirichenko (A.).] **Кириченко (А.). Preliminary Report on the Scale-insects of the Ukraine and the Crimea.** [*In Russian.*]—*Prot. Pl. Ukraine*, iii-iv, pp. 112–116. Kharkov, 1928.

Trujillo Peluffo (A.). *Margarodes vitium*, **Giard. Cochinilla perjudicial a la vid en el Uruguay.** [*M. vitium*, a Coccid injurious to the Grape-vine in Uruguay.]—*Rev. Fac. Agron. Univ. Repúb.*, no. 1, pp. 75–83, 6 figs. Montevideo, August 1928. [*Cf. R.A.E.*, A, xi, 320.]

Boratynski (K.). **Sur l'anatomie de la femelle de** *Margarodes polonicus*, **Ckll.**—*C.R. Soc. Biol.*, xcix, no. 27, pp. 1045–1047. Paris, 5th October 1928.

Kalicka-Fijalkowska (J.). **Le développement embryonnaire de** *Margarodes polonicus*, **Ckll.**—*C.R. Soc. Biol.*, xcix, no. 27, pp. 1047–1048. Paris, 5th October 1928.

Green (E. E.). **Further Observations on** *Beesonia dipterocarpi*, **Green.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 205–207, 3 figs. London, October 1928. [*Cf. R.A.E.*, A, xiv, 459.]

KITAO (Z.). **Notes on the Anatomy of** *Warajicoccus corpulentus*, **Kuwana, a Scale Insect noxious to various Oaks.**—*J. Coll. Agric. Tokyo*, x, no. 1, pp. 1–20, 29 figs., 14 refs. Tokyo, July 1928.

WEBER (H.). **Skelett, Muskulatur und Darm der schwarzen Blattlaus** *Aphis fabae* **Scop.** [The Skeleton, Musculature and Intestine of *A. fabae*.]—*Zoologica*, xxviii, Heft 76, Lief. 5–6, pp. 1–120, 12 pls., 15 figs., 7 tables, 60 refs. Stuttgart, 1928.

MELIS (A.). **Osservazioni anatomo-morfologiche sulle larve del** *Dacus oleae* **Rossi e del** *Bibio hortulanus* **L., con particolare riferimento alla struttura degli stigmi.** [Morphological Observations on the Larvae of *D. oleae*, Gmel., and *B. hortulanus* with special Regard to the Structure of the Stigmata.]—*Riv. Biol.*, x, no. 3–4, pp. 411–451, 8 figs., 79 refs. Milan, 1928.

HODSON (W. E. H.). **Some Notes on the Bulb Mite** [*Rhizoglyphus echinopus*].—*J. Minist. Agric.*, xxxv, no. 7, pp. 656–660, 2 refs. London, October 1928. [*Cf. R.A.E.*, A, xvii, 21.]

SWINGLE (H. S.), U.S. Bur. Ent. **Digestive Enzymes of the Oriental Fruit Moth** [*Cydia molesta*, **Busck**].—*Ann. Ent. Soc. Amer.*, xxi, no. 3, pp. 469–475, 4 refs. Columbus, Ohio, September 1928.

DOBKIEWICZ (L. v.). **Der Einfluss von Schilddrüsenfütterung auf Entwicklung, Wachstum und Fortpflanzung des Speckkäfers** (*Dermestes frischii*, **Kg.**). [The Influence of Thyroid Gland Ingestion on the Development, Growth and Reproduction of *D. frischi*.]—*Arch. Entwicklungsmech. Organismen*, cxiv, no. 2–3, pp. 458–499, 3 figs., 1 ref. Berlin, 4th December 1928.

FEYTAUD (J.). **Le négril de la luzerne.** [*Colaspidema atrum* attacking Lucerne.]—*Rev. Zool. agric. appl.*, xxvii, no. 6, pp. 85–88. Bordeaux, June 1928. [*Cf. R.A.E.*, A, xiv, 116.]

MURAYAMA (J.). **Supplementary Notes on the Platypodidae of Formosa II.**—*J. Coll. Agric. Hokkaido Imp. Univ.*, xix, pt. 5, pp. 283–290, 1 pl., 5 refs. Sapporo, September 1928. [*Cf. R.A.E.*, A, xiii, 463.]

[KISELEVA (E. F.).] **Киселева (Е. Ф.). A Note on Bark-beetles in the Neighbourhood of Tomsk.** [A List of 19 Species with their Food-plants.] [*In Russian.*]—*Trans. Tomsk State Univ.*, lxxix, no. 4, pp. 243–246, 12 refs. Tomsk, 1928.

[KISELEVA (E. F.).] **Киселева (Е. Ф.). Chrysomelidae in the Neighbourhood of Tomsk.** [A List of 104 Species with their Food-plants.] [*In Russian.*]—*Trans. Tomsk State Univ.*, lxxix, no. 4, pp. 247–260, 26 refs. Tomsk, 1928.

LOCHHEAD (A. G.). **Cultural Studies of** *Bacillus larvae* (**White**) [causing American Foulbrood in Bees].—*Sci. Agric.* ix, no. 2, pp. 80–89, 10 figs., 12 refs. Ottawa, October 1928.

TOUMANOFF (K.). **Au sujet de l'aspergillomycose des abeilles.** [The Infection of Bees with *Aspergillus flavus*.]—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 7, pp. 391–393. Paris, 1928.

PAILLOT (A.). **Sur la gattine amicrobienne expérimentale et sur le rôle des substances cytotoxiques intestinales dans l'épidémiologie de la gattine et de la flacherie vraie.** [The Experimental Production of amicrobic Gattine of Silkworms (*Bombyx mori*) and the Part played by intestinal cytotoxic Substances in the Epidemiology of Gattine and true Flacherie.]—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 16, pp. 679–681, 1 ref. Paris, 1928.

[Spesivtzev (P. N.).] Spessivtseff (P.). **Studier över de svenska barkborrarnas biologi särskilt med hänsyn till generationsutvecklingen. Del I.** *Hylurgops glabratus*, **Zett.,** *Carphoborus cholodkovskyi*, **Spess.,** *Dryocoetes autographus*, **Ratz.,** *Dryocoetes hectographus*, **Reitt.** [Studies on the Biology of Swedish Bark-beetles with particular Reference to the Question of Generations. Part I.] —*Medd. Skogsförsöksanst.*, xxiv, no. 8, pp. 221–250, 16 figs., 13 refs. Stockholm, 1928. (With a Summary in German.)

Information regarding the generations of bark-beetles is lacking for some species, and in other cases the data available do not apply to Sweden. The occurrence of generations lasting two years was first definitely proved by the author, and this has a bearing on the biology and the economic importance of the species concerned. As it is often necessary to identify a species in the forest from larvae and pupae, these stages are described, only such characters being given as can be seen with a pocket-lens.

Hylastes (*Hylurgops*) *glabratus*, Zett., has a two-year generation in Sweden. Oviposition begins in the second half of June, and new mother-galleries are most plentiful in mid-July. They occur under the thick bark of stems of spruce or occasionally pine that have been felled in the preceding autumn, winter or early spring. Only on two occasions were mines found in standing trunks. The larvae hibernate, usually associated with those of *Hylastes cunicularius*, Er., *H. ater*, Payk., *Dryocoetes autographus*, Ratz., and *D. hectographus*, Reitt. In spring the larvae of *H. glabratus* resume feeding. At the end of May or early in June they gnaw pupal chambers in the bast, the first pupae occurring about mid-June. By the end of June or early in July, the adults begin to appear and feed. By October a few remain under the bark and hibernate there, but most of the young beetles hibernate in the ground-litter. Normal mother-mines with eggs do not occur then. Young, hibernated adults are not seen in the forest in May or June until the oviposition period.

In Sweden *Carphoborus cholodkovskyi*, Spes., flies from the end of June to mid-August, usually mining pines previously attacked by *Myelophilus* (*Blastophagus*) *piniperda*, L., and *M.* (*B.*) *minor*, Htg. Examination of dying and dead pines in the second half of July showed mines with recently deposited eggs and mines with young adults. In spruce blocks containing eggs and larvae in August 1923, nearly all old beetles were alive up to July 1924. The females had oviposited in the preceding year's mother-galleries. In mid-summer a few of the old beetles left these blocks and bored into others. The larvae did not begin to pupate till June 1925. On 18th July a few young adults were seen, and by 22nd August only adults were present. They hibernated under the bark and gnawed exit-holes in June 1926. In this case, therefore, the life-cycle lasted three years.

Dryocoetes autographus, Ratz., and *D. hectographus*, Reitt., have very similar habits. The former occurs throughout Sweden; the latter chiefly in the north. Though usually attacking spruce, they occur on pine in mixed stands. They infest dead trees only, *i.e.*, stems felled in the previous autumn or winter. They have a two-year generation, hibernating first as larvae and then as adults. Some of the young adults hibernate where they were bred, others migrate to other trees, and some probably hibernate in the litter. Some females mate (irrespective of their state of maturity) in autumn, though actual fertilisation does not occur until the following summer. In order to

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feed, the hibernated adults gnaw their way out early in summer (first flight). The eggs are laid from the end of June to early August (second flight) on roots, stumps and fallen trunks. *D. autographus* prefers moist parts of the trees, while *D. hectographus* often chooses dry ones. The form of the brood-mines varies in both species.

STRAWINSKI (K.). **Tepiene owadów paradwuchlorobenzolem.** [Control of Insects with Paradichlorobenzene.]—*Las Polski*, no. 5, reprint 11 pp., 1 fig., 6 refs. Warsaw, 1928. (With a Summary in English.)

Previous work with paradichlorobenzene in America and elsewhere is reviewed, including that of Golovyanko, which is discussed in detail [*R.A.E.*, A, xvi, 293]. Experiments were made in Poland in 1925 for the control of the larvae of *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., for which purpose holes about 2 ins. deep were made in sandy soil at the rate of about 16 holes to the square yard. A dose of about $\frac{1}{7}$ oz. [4 gm.] killed all the larvae. Experiments were also made in the autumn of 1927 for the control of *Aradus cinnamomeus*, Pnz., which attacks pine trees and hibernates in the bark close to the ground. Powdered paradichlorobenzene was applied in rings on the ground under each tree. Some of the bugs, which had fallen from the trees, were killed by November, and in December some of those on the trunks 2 or 3 inches above the ground were also killed, but the actual results of these experiments cannot be known until hibernation is over. Under laboratory conditions these insects were killed by paradichlorobenzene within 1–2 hours in closed containers and within 12–15 hours in open cages. Paradichlorobenzene does not affect the bark of pine trees 15 to 20 years old.

REISSIG (—). **Ueber** *Strophosomus coryli* **und** *obesus*, **die Schmerbauchrüssler.** [*S. coryli* and *S. obesus*.]—*Forstw. Zentralbl.*, 1, no. 9, p. 316, 1928. (Abstract in *Fortschr. Landw.*, iii, no. 18, p. 860. Vienna, 15th September 1928.)

The weevils, *Strophosomus coryli* and *S. obesus*, have usually been recorded as pests of conifers, infestation of oaks being only of occasional importance. The author, however, records serious attacks of young beech in the Palatinate. The rather intensive exploitation of all forest products, including even the forest-litter, has transformed these weevils into most dangerous pests of naturally regenerated beech. They oviposit preferably on *Aira flexuosa* and dry *Hylocomium*, and the larvae feed on the roots of these weeds. The mature weevils feed in spring, and the young ones in mid-summer. Hibernation takes place in sand beneath the ground-litter. The tender bark of one- to four-year-old trees is gnawed or ringed. Pine seedlings are destroyed, as are those of oak and beech where infestation is severe. The constant attack on young beeches kills the more severely ringed branches and sometimes even the tree itself. Young beeches in mixed stands of beech and pine are the ones most damaged. Measures against these weevils must include soil protection and soil amelioration, and afforestation should be effected with strong, four-year-old fresh trees. Spraying with arsenicals is sometimes useful.

Schmidt (M.). **Schädliche Spinnerraupen an Garten-, Park- und Strassenbäumen.** [Injurious Lepidopterous Larvae on Shade-trees.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 6, 8 pp., 6 figs. Berlin, 1928.

A popular key to the Lepidopterous larvae that are pests of shade trees in Germany is given, with brief descriptions of the biology and control of each species.

Wilke (S.). **Zur Kenntnis der Lebensweise und Schädlichkeit der Pflaumensägewespe (*Hoplocampa minuta*, Christ).** [A Contribution to the Knowledge of the Biology of the Plum Sawfly, *H. fulvicornis*, Klug, and the Injury it causes.]—*NachrBl. deuts. PflSch-Dienst*, vii, no. 10, pp. 91–94, 2 figs. Berlin, October 1928.

The investigations in Berlin on the plum sawfly, *Hoplocampa fulvicornis*, Klug (*minuta*, Christ) [*R.A.E.*, A, xv, 557] were continued in 1928. The adults were abundant at the end of April and early in May and oviposited chiefly on the open blossoms, not on the blossom-buds as stated in the literature. It has been said that the varieties of plum that blossom during cold, wet weather suffer least because the sawflies are less able to withstand these conditions than the blossoms, but this was not confirmed in spite of varying weather conditions. Oviposition lasted over 10 days, with two peaks separated by a 2–3 day interval not due to the weather and possibly connected with the maturing of the eggs. The eggs are laid in the calyx. As a rule one egg is laid in each blossom, though as many as five have been found. Larvae have been observed within 5 days after the first oviposition, but incubation may last more than 2 weeks. On hatching, the larva wanders to the ovary and bores into it. As a rule, 4 fruits are attacked before pupation, but as many as 6 are sometimes infested. On an average, feeding under experimental conditions took 24·2 days with 4 fruits and 28 with 5. The physiological fall of fruits must decrease the number of sawflies, because individuals in these fallen fruits cannot develop. To control *H. fulvicornis* it is necessary to apply an arsenical spray at weekly intervals from the first week in May to the first week in June.

Stübinger (H.). **Ueber die Wirkung verschiedener Schädlingsbekämpfungsmittel auf niedere Tiere.** [On the Action of various Insecticides on lower Animals.]—*Anz. Schädlingsk.*, iv, nos. 9–10, pp. 116–119, 130–134, 7 refs. Berlin, 1928.

This investigation was undertaken to ascertain the general effect of the chief insecticides on insects, particularly bees. The experiments, which are described in detail, were made on Trichoptera (caddis larvae) and bees with potassium arsenite, Paris green, calcium arsenite, calcium arsenate, hydrocyanic acid gas, nicotine, sodium fluoride, lead acetate and lead nitrate. A lowering of cardiac activity was noticed with arsenic and with sodium fluoride in the case of the caddis larvae, while in bees there was also an attempt to vomit the poison. With weak solutions, the poison is retained in the body, and the effect is more marked than with strong solutions, most of the poison in which is excreted. The approximate lethal doses required for 1,000 gms.

weight of bees, calculated on the amount required for one bee, were: As, 5 mgm., in about 1½–3 hours; HCN, 0·15 mgm., in about 20 hrs.; nicotine, 0·3 mgm.; sodium fluoride, 0·15 mgm., in about 20 hrs.; lead acetate or lead nitrate, 750 mgm. in 1–5 days. Sodium fluoride having proved highly poisonous to bees and Trichoptera, further experiments with its compounds should be made, particularly as they are stated not to injure plants.

STAEHELIN (M.). **Die Pyrethrumseifenlösung als Insektizid.** [Pyrethrum-soap Solution as an Insecticide.]—*Anz. Schädlingsk.*, iv, no. 10, pp. 127–130, 9 refs. Berlin, 1928.

This account is taken from published sources in view of the success that has attended spraying with pyrethrum-soap solution against the vine-moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] and the cultivation of *Pyrethrum cinerariaefolium* in Switzerland [*R.A.E.*, A, x, 231, 320; xii, 563; xiii, 298, 301, 595].

SCHIMITSCHECK (E.). **Beobachtungen bei einer Uebervermehrung der Tannentrieblaus** *Dreyfusia nüsslini*, **C.B.** [Observations during an Outbreak of *Chermes nüsslini*.]—*Anz. Schädlingsk.*, iv, no. 10, pp. 135–136. Berlin, 1928.

An outbreak of *Chermes* (*Dreyfusia*) *nüsslini*, Börn., that occurred on silver fir [*Abies*] in the Rhine Palatinate in 1923 was due largely to climatic conditions favourable to the Aphid, both climate and soil being unfavourable to the trees. If an outbreak occurs, remedial measures should be undertaken immediately. It is necessary to spray during two consecutive years. One application should be made when the buds are opening and another 3–4 weeks later. Birds, especially tits, should be protected. It has been found that the dying of silver firs, ascribed to *C.* (*D.*) *piceae*, Ratz., does not occur unless one of the principal factors necessary for the maintenance of a healthy condition of the trees is absent.

HERING (M.). **Beiträge zur Kenntnis der Oekologie und Systematik blattminierender Insekten. (Minenstudien ix.)** [Contributions to the Knowledge of the Ecology and Classification of Leaf-mining Insects.]—*Zool. Jahrb.*, Abt. Syst., lv, pp. 535–588, 1 pl., 4 figs., 11 refs. Jena, 1928.

This further instalment of a paper on leaf-mining insects, again chiefly from Germany [*R.A.E.*, A, xvi, 2], includes a key to the leaf-miners of *Aster*, a key to species related to *Phytomyza albiceps*, Mg., and descriptions of some new species.

LÜSTNER (G.). **Der Pappeltriebwickler,** *Semasia aceriana*, **Dup.**—*Ber. Lehr.- u. Forsch. Anst. Wein- Obst- u. Gartenbau, 1926*, pp. 62–63. Geisenheim a. Rh., 1927. (Abstract in *Centralbl. Bakt.*, (2) lxxv, no. 25–26, p. 553. Jena, 24th October 1928.)

The Tortricid, *Gypsonoma* (*Semasia*) *aceriana*, Dup., which attacks various species of *Populus* and *Acer*, is recorded as boring into the shoots of *P. nigra* and causing gall-like swellings. In breeding experiments pupation occurred in the shoots, and the first adults appeared on 21st June.

Franssen (C. J. H.). **De biologie en systematiek der Nederlandsche "zwarte bladluizen."** [The Biology and Classification of the Dutch "black Aphids."]—*Natuurhist. Maandblad*, xvii, no. 9, p. 131. Maastricht, 28th September 1928.

Continuing his work on the "black Aphids" in Holland [*R.A.E.*, A, xvi, 541], the author gives an account of the group of species allied to *Aphis medicaginis*, with a key to all the groups so far discussed.

Soffner (J.). *Plutella maculipennis* **Crt. als Kohlschädling. (Microlep.).** [*P. maculipennis* as a Cabbage Pest.]—*Ent. Z.*, xlii, no. 12, p. 146. Frankfort-on-M., 22nd September 1928.

Plutella maculipennis, Curt., is recorded from Bohemia as doing serious damage to cabbage, the larvae feeding in large numbers on the lower surface of the leaves.

Malenotti (E.). **Le spolverizzazioni arsenicali contro la Tignola del Melo** (*Hyponomeuta malinellus*, **Zell.**). [Dusting with Arsenicals against the Apple Moth.]—*Italia agric.*, 1928, no. 8, reprint 13 pp., 11 figs. Piacenza, August 1928.

An account is given of successful experiments made in Italy in the spring of 1928 against the apple moth, *Hyponomeuta malinellus*, Zell., with a proprietary arsenical dust, and the comparative advantages of dusting and spraying are discussed.

[Miller (D.).] **Establishment of beneficial Insects in New Zealand.**—*N.Z.J. Agric.*, xxxvii, no. 3, pp. 193–195, 6 refs. Wellington, 20th September 1928.

This is a summary of the biological control operations in New Zealand during the year ended March 1928.

Misocyclops marchali, Kieff., a parasite of the pear-midge [*Dasyneura pyri*, Bch.], has been distributed throughout the midge-infested areas of the Dominion [*cf. R.A.E.*, A, xvi, 78], adult parasites instead of infested pear leaves being distributed outside the fireblight areas. Near Auckland, in the spring of 1927, a very decided increase of parasites was noted in the field, correlated with a marked improvement in the health of the trees and a decrease of midge infestation. During January 1928, large numbers of parasites were reared from infested leaves collected in an orchard near Nelson, in which three females and one male had been liberated 15 months previously.

Numerous individuals of a Mymarid egg parasite of the gum-tree weevil [*Gonipterus scutellatus*, Gyll.] were bred from a consignment from Australia towards the end of 1927. These were liberated in many districts.

Three consignments of larvae of *Lachnosterna* sp. parasitised by *Microphthalma michiganensis*, Towns., were imported from Canada with the intention of establishing this Tachinid against the New Zealand grass-grub, *Odontria zealandica*, White. The first two arrived in October 1926, and the third in December 1927. Within three-months of their arrival, 106 adult parasites emerged, nearly all these being from the third consignment. In February 1928, some of these were liberated in three localities, and others over pasture artificially infested

with the grass-grub. Adults lived in captivity for 8 days. Though this Tachinid and its host take two or more years to develop and *O. zealandica* only one, it was thought that the parasite might adapt itself to conditions in New Zealand, since in Canada it has at times developed in a period much shorter than the normal one.

DUPONT (P. R.). **Entomological and Mycological Notes.**—*Ann. Rep. Dept. Agric. Seychelles 1927*, pp. 3–4. Victoria, Seychelles, 1928.

Owing to drought, an undescribed species of *Kusanoa* and another fungus previously recorded [*R.A.E.*, A, xv, 523], infesting *Pinnaspis buxi*, Bch., and *Ischnaspis longirostris*, Sign. (*filiformis*, Dougl.) respectively, were comparatively ineffective. Consequently the Coccids were more than ever injurious to coconut palms. In many localities, however, these fungi are causing the disappearance of scale-insects attacking coconut.

BONDAR (G.). **Boletim do Laboratorio de Pathologia vegetal,** no. 3. 1925, 97 pp., 38 figs.—Bahia, Sec. Agric. Ind. Com., 1926. [Recd. 1928.]

This is a report on the insect pests of coffee, tobacco, rubber, coconut, cotton, cassava, Anonaceae and guavas in the state of Bahia, Brazil, practically all the information having already been noticed from other sources.

FAIRBAIRN (V. M.). **The Life-history of** *Erythroneura ziczac*, **Walsh (Homoptera, Cicadellidae).**—*J. Kansas Ent. Soc.*, i, no. 4, pp. 79–84, 3 refs. McPherson, Kans., October 1928.

The Jassid, *Erythroneura ziczac*, Walsh, shows a decided preference for Boston ivy (*Parthenocissus tricuspidata*), Virginia creeper (*P. quinquefolia*) coming next. Grape vines are only attacked in the absence of these. Both nymphs and adults remove chlorophyll from the leaves, which dry up in severe infestations, and cause small pale yellow spots on them. Virginia creeper is often severely defoliated.

The eggs, which are covered with a bluish-grey deposit, are laid mostly in groups, though frequently singly, just beneath the epidermis on the lower surface of the older leaves of Boston ivy. Notes are given on the time of appearance of the various stages; there appear to be four generations a year in Kansas. Hibernation occurs in the adult stage.

HEADLEE (T. J.). **Some Data relative to the Relationship of Temperature to Codling Moth Activity.**—*J. N. Y. Ent. Soc.*, xxxvi, pp. 147–163, 2 refs. New York, N.Y., June 1928.

The following is the author's abstract: Thermal constants for beginning emergence and maximum emergence of the overwintered generation and the first summer generation of codling moth [*Cydia pomonella*, L.], determined by summation of day-degrees of effective temperature, exhibit a sufficiently small amount of variation from year to year to render them satisfactory indicators of time when insecticidal applications should be made for the control of the larvae of that insect entering apples, but the dates, as determined by the thermal constants,

should be checked against the codling moth bait pan records in order to make sure that the season in question does not exhibit some unusual type of variation. While the dates of beginning emergence and maximum emergence of the overwintered generation and the first summer generation seem to vary according to the latitude and altitude phase of the bioclimatic law, the writer feels that further data should be secured before dependence is placed upon this principle for determining the dates of insecticide applications. When the average weekly minimum temperature [in late summer or early autumn] approaches 60° F., codling moth transformation from larva to pupa ceases. It is probable, however, that the determination of this tendency of larvae to pupate occurs under a somewhat higher average minimum than 60° F., and it seems, in the writer's experience, that this determination of tendency takes places before the larva starts to spin its cocoon.

Zoology and Entomology.—*41st Ann. Rep. Pennsylvania Agric. Expt. Sta. 1927–28*, Bull. 230, pp. 39–43, 1 fig. State College, Pa., July 1928.

The bulk of the information given in this report has been previously noticed [*R.A.E.*, A, xiv, 639 ; xvi, 516, 565, etc.]. Steam sterilisation of the soil of a sweet pea greenhouse severely infested by *Scutigerella immaculata*, Newp., by the use of underground tiles, was only partly successful, since although the soil temperature rose above 160° F., many of the Symphilids escaped by entering cracks in the concrete walls of the beds. A list is given of a number of substances used against this pest, none of which was effective.

Biological studies on flies, mites and springtails infesting mushrooms, have been continued ; the average length of the life-cycle of *Sciara* sp. from oviposition to the emergence of the adult, at a laboratory temperature of between 62 and 68° F., was 23 days. It was found that different grades of pyrethrum powder vary considerably in their toxicity, and the best, made from the flowers only, should be used. Paradichlorobenzene was toxic to the mites but retarded the mushroom crop, while burning sulphur was found to kill both mites and *Sciara*.

Six methods of harvesting and handling the maize crop and preparing the ground for oats in order to check the European corn borer [*Pyrausta nubilalis*, Hb.] have been tested ; less débris was left on the surface when the maize was husked standing, the stalks broken off by dragging with an iron-shod plank in early spring, raked into piles when dry and burned before ploughing, than if any of the other five methods were employed. The percentage of efficiency as regards amount of stalk débris given by various attachments to ploughs is discussed.

Jacobsen (W. C.). [**Report for 1927 of the**] **Bureau of Plant Quarantine and Pest Control.**—*Mon. Bull. California Dept. Agric.*, xvi, no. 12, pp. 633–677. Sacramento, Cal., 1928.

A State-wide campaign is to be carried out to eliminate endosepsis of figs disseminated by *Blastophaga* [*psenes*, L.], the programme for which is outlined [*R.A.E.*, A, xvi, 319].

To ensure greater uniformity in the enforcement of nursery stock inspection to prevent the spread of citrophilus mealybug [*Pseudococcus gahani*, Green], a regulation was promulgated by which a presumed

area of infestation was limited to the boundaries of a nursery. This encouraged nurserymen to concentrate on measures of eradication, since their ability to send stock to clean areas depended entirely on their own efforts. Investigations by the Federal Bulb Insects Laboratory at Santa Cruz indicate the possibility of calcium cyanide dust being effective against bulb flies [*Eumerus strigatus*, Fall., and *Merodon equestris*, F.], and it may prove valuable as a substitute for vacuum fumigation [*cf. R.A.E.*, A, xvi, 194].

In the report on the Plant Quarantine Service by A. C. Fleury, the State laws and regulations for the protection of plants from pests and diseases in California are very briefly summarised. The activities of the maritime and border inspection services are reviewed. The annual survey made in the spring of 1927 to determine the spread of the alfalfa weevil [*Hypera variabilis*, Hbst.] showed that the infestation was still well within the quarantine boundary lines originally established, the spread up to the present being by natural flight along continuous lucerne plantings. A survey in the part of Nevada adjoining California revealed the presence of the weevil in a small portion of one field. The crop of the entire field was destroyed by ploughing and burning in the hope of eradicating the pest, and this locality was immediately added to the area under quarantine.

T. D. Urbahns and H. C. Lewis, in their report on Field Entomology, give a brief outline of work on *Listroderes obliquus*, Gyll. (vegetable weevil) [*R.A.E.*, A, xvi, 257; xvii, 35]. *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., and *O.* (*B.*) *rugostriatus*, Goeze, were found to be generally distributed in strawberry, blackberry, raspberry and loganberry plantings in one locality, while *O. rugostriatus* and *O.* (*B.*) *ovatus*, L., were associated in another locality. Considerable damage had been done in a few fields. Larvae of another weevil, *Pantomorus godmani*, Crotch, were also found attacking strawberry plants. An unusually heavy outbreak of *Alsophila pometaria*, Harris, and *Palaeacrita vernata*, Peck, occurred on deciduous fruit in April and May. Very effective control was obtained by using 2½ lb. ground pyrethrum to 100 U.S. gals. spray. Several fields of maize were entirely destroyed by *Elasmopalpus lignosellus*, Zell. (lesser corn stalk borer). The Scolytid, *Phloeosinus cristatus*, Lec., caused severe injury to Monterey cypress [*Cupressus macrocarpa*] in parks during October. The summer brood of beetles girdled the trunks and larger branches and caused the death of the trees. The smaller twigs of Arizona cypress [*C. arizonica*] were also attacked. Monterey cypress is not suited to the drought conditions of the interior; it becomes weakened, heavy infestations are then established, and healthy Arizona cypress and Italian cypress [*C. sempervirens*] are subsequently attacked. The heavily infested trees and branches should be cut down and burned in the late autumn or winter, thus preventing the breeding of the main broods. Cypresses should not be planted near *Eucalyptus*, because these trees exhaust the water supply, and Monterey cypress should not be planted far from the coast

Anarsia lineatella, Zell. (peach twig borer) is becoming of increasing importance on prunes in some localities. The injury caused by the larvae at the junction of stem and fruit causes the latter to fall prematurely. The greatest amount of injury occurred during the latter part of July and August. *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) was less abundant, largely owing to control measures [*R.A.E.*, A, xvi, 253]. Some pear growers obtained good results

against it by increasing the amount of basic lead arsenate used. Infestations by *Tetranychus telarius*, L. (red spider) were unusually light, possibly owing to climatic conditions and its natural enemies. Grasshoppers caused more damage than in 1926; *Melanoplus differentialis*, Thomas, was abundant in the lucerne-growing districts of the San Joaquin Valley. An outbreak of *Heliothrips fasciatus*, Perg. (bean thrips) occurred on pears in the coastal mountain valleys. Various insecticides were tested against it in July and August, the most effective being a combination of a light miscible oil with nicotine sulphate. Ground pyrethrum and pyrethrum extracts were almost as satisfactory, but were not so readily available. A list is given of the more important insects causing economic loss in 1927, together with the crops injured.

Recommendations prepared in conjunction with the Division of Entomology, University of California, are made for the control of diseases and pests of celery and lettuce. Poison bran mash is recommended against cutworms. On celery, arsenicals should be used only while the plants are young, no application being made after the plants are half-grown, and in no case less than 45 days before harvest. No lead or calcium arsenate dusts or sprays should be used at a higher rate than 4 lb. to the acre. For lettuce, poison baits should be used instead of arsenicals wherever possible, and all spraying or dusting should be done before the heads are formed. Clean cultivation will reduce the numbers of pests.

In his report on the Nursery Service, E. L. Smith states that for the first time since the original infestation that was eradicated several years ago, *Otiorrhynchus rugostriatus* was found in California; it was associated with *O. sulcatus*. Trials showed that effective control could be obtained by broadcasting a bait of dried apple or apple pomace poisoned with an arsenical. *Idiocerus scurra*, Germ. (poplar leaf hopper) was reported for the first time from California.

Mackie (D. B.). **Progress in Citrus White Fly Suppression in the Northern California Areas.**—*Mon. Bull. California Dept. Agric.*, xvi, no. 12, pp. 677–686. Sacramento, Cal., 1928.

The situation regarding *Dialeurodes citri*, R. & H. (citrus whitefly) in California up to December 1926 is briefly surveyed. An intensive spraying campaign was then undertaken, and it was found that 2 per cent. emulsions of a number of the higher grade summer oils killed all stages of the Aleurodid with which they came into contact. A list of 114 potential food-plants was made. Inspection on completion of the winter spraying with oil emulsion showed a number of isolated infestations outside the larger areas; these were sprayed as soon as possible. During July and August all preferred food-plants in blocks showing heavy infestation were again treated. Summer inspection showed that owing to the reduction in its numbers, the insect remained primarily on the preferred food-plants and did not spread to such a wide range of plants. As a result it was possible to reduce the number of different plants to be sprayed from 114 to 37. The second spraying campaign was begun in December 1927, and a table is given showing the greater efficiency attained. Final inspection showed a reduction of 99·983 per cent. in the infestation by *D. citri*, and since no individuals were found in areas where infestation had been slight, eradication would appear to be possible.

STEARNS (L. A.). *Erythroneura hartii* (**Gill.**), **an occasional Leafhopper Pest on the Apple.**—*Tech. Bull. Virginia Agric. Expt. Sta.*, no. 33, 15 pp., 5 pls., 20 refs. Blacksburg, Va., January 1928.

In the course of a study of the Homopterous fauna of Virginia during 1918–22, it was observed that *Erythroneura harti*, Gill., was increasing until it outnumbered all the other apple leafhoppers occurring in any abundance in the State, namely, *Typhlocyba pomaria*, McAtee, *Empoasca fabae*, Harr., *Erythroneura obliqua*, Say, and *E. dorsalis*, Gill. *Empoasca maligna*, Walsh, was unusually scarce on apple at the time, and *E. fabae* was largely confined to potato. Although occasionally reported on rye, among leaves and on mosses and oak, *E. harti* has always been recorded in varying abundance on apple, and this may be its sole food-plant. The distinctive characters of the leafhoppers associated with apple are enumerated. Both nymphs and adults of *E. harti* injure the foliage by extracting the juices from the lower surface of the leaves, and in addition there is distortion and whitening of the leaves during summer and autumn; the appearance of the fruit is damaged by the excreta of the nymphs and adults, which create a spotted rusty-coloured surface that entails a thorough wiping before packing. The stages of *E. harti* are described, as well as the life-history as studied in the insectary and observed in the field. The winter is passed in the adult stage. By mid-April the adults resume activity, and pairing takes place, with a certain amount of feeding on the young, terminal leaves. The first generation in the insectary was at its maximum on 1st August and the second during the last 10 days of September, the two generations overlapping somewhat and each requiring about 2 months for development from egg to adult. The usual orchard sprays gave little protection against *E. harti*. Trees sprayed five times and still heavily coated with Bordeaux-lead arsenate spray were severely infested. The inclusion of nicotine in the early June and late July sprays, when the nymphal infestation is high, might give adequate protection.

Division of Entomology.—*47th Ann. Rep. N. Y. Agric. Expt. Sta. 1927–28*, pp. 44–51. Geneva, N.Y., 1928.

Some of the information given in this report has been previously noticed [*R.A.E.*, A, xvi, 318, 641]. The degree of infestation of store houses by the codling moth [*Cydia pomonella*, L.] and the danger to adjoining orchards from moths reared in them have been investigated. Adults did not emerge until the temperature in the houses rose to 68 or 70° F., the majority emerging about a week after or before 15th July, some three weeks later than the appearance of moths reared in normal conditions. Control measures are based on the activities of moths bred in orchards, and it is thought that the occurrence of large numbers of belated individuals originating in warehouses, etc., would constitute a menace to neighbouring orchards. The peach scale, *Pulvinaria* (?) *amygdali*, Ckll., can be controlled by an oil spray applied when the buds are swelling. *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) has now been discovered in two widely separated districts in the State. Since there is no satisfactory method of protecting peach orchards by means of insecticides, arrangements have been made for the importation and dissemination of parasites.

The use of a 3 per cent. nicotine and dolomite dust in heavy dosages

has been found to give the best control of the cucumber beetle [*Diabrotica vittata*, Say], its efficiency, however, depending entirely on a thorough contact with the beetles. To ensure this, squash seed was sown weekly for three weeks, thus supplying a succession of seedling plants and eliminating foliage interference. The lethal qualities of the dust were greatly increased by dry conditions. Trap-crops are only effective if the main crop has been treated with repellents and has not begun to blossom. Comparative tests with spray and dust mixtures as repellents showed that arsenical dusts were less toxic to plant growth than nicotine dusts. Of the arsenical dusts, those containing gypsum were more beneficial to plant growth than those containing hydrated lime, while sprays containing casein-lime gave superior results to those containing fish-oil. The comparative yields of cucumber depended more on the effect of the dusts on the plant growth than on their relative value as insect repellents.

The most injurious insect in cauliflower seed-beds in 1927 was *Phorbia* (*Hylemyia*) *brassicae*, Bch. (cabbage maggot); numerous materials have been tried as a control for this pest, those giving the best results including aqueous solutions containing mercury bichloride, 1 to 1,250, or sodium fluosilicate, 1 to 250. Cheese or tobacco cloth placed on plants of about four weeks old as a protection against Aphids and the diamond-back moth [*Plutella maculipennis*, Curt.] only caused slight malformation in stem growth.

Pettit (R. H.). **Report of the Section of Entomology.**—[*65th Ann. Rep. State Bd. Agric. Michigan 1925–26*], reprint 23 pp., 20 figs. [East Lansing, Mich., 1927.] [Recd. 1928.]

Among the insect pests recorded from Michigan during the year ending 30th June 1926, the following are of particular interest: *Trioza tripunctata*, Fitch (blackberry Psyllid), of which an unusual attack occurred on wild blackberry on the site of an old nursery, the leaves becoming curled and stunted; *Stilbus* (*Eustilbus*) *apicalis*, Melsh., which was found to be eating the roots of seed onions; and *Ellopia fiscellaria*, Guen. (hemlock looper), which caused serious defoliation of various trees, hemlock [*Tsuga*] being preferred. The stages of *E. fiscellaria* and its life-history as observed by C. B. Dibble [*R.A.E.*, A, xiv, 276] are described. The following parasites were bred from the pupae: *Amblyteles velox*, Cress., *A. puerilis*, Cress., *Pimpla* (*Itoplectis*) *conquisitor*, Say, and *Ephialtes pedalis*, Cress.

Watson (S. A.). **The Miridae of Ohio.**—*Ohio State Univ. Bull.*, xxxiii, no. 4 (*Biol. Surv. Bull.* 16), 44 pp., 3 pls., 6 figs., 1 map, 1 chart, 9 refs. Columbus, Ohio, 15th November 1928.

A list of the Capsids occurring in Ohio is given with notes on their biology and ecology. The following are the species of economic importance: *Miris dolabratus*, L. (meadow plant-bug) in meadows, especially of timothy grass; *Lygus pratensis*, L. (tarnished plant-bug), which attacks a number of cultivated plants and fruit-trees. *Poecilocapsus lineatus*, F., which has been found on about fifty plants, including various vegetables, bush-fruits and clovers; *Halticus citri*, Ashm. (*uhleri*, Giard) (garden flea-hopper), which attacks various plants, causing much damage to sugar-beet; *Chlamydatus* (*Agalliastes*)

associatus, Uhl. (false flea-hopper), which attacks sugar-beets in mid-summer, but causes little damage ; *Stenotus binotatus*, F. (timothy grass bug), which is more abundant on orchard grass than on timothy in Ohio ; *Adelphocoris rapidus*, Say (cotton leaf bug), which is found in large numbers on grasses and clovers and has been recorded as damaging sugar-beet ; *Heterocordylus malinus*, Reut. (dark apple red bug) ; *Lygidea mendax*, Reut. (light apple red bug), which causes serious damage to apple ; *Lygus invitus*, Say (false tarnished plant bug), which has been reported as damaging pears in New York State ; *Stenodema trispinosum*, Reut., which is often abundant on timothy ; and *Trigonotylus ruficornis*, Geoffroy, which is occasionally abundant in fields of wheat and oats.

Felt (E. P.). **Dispersal of Insects by Air Currents.**—*New York State Mus. Bull.*, no. 274, pp. 59–129, 4 pp. refs. Albany, N.Y., April 1928.

Meteorological data relative to air currents are discussed, and their effect on the dispersal of insects over land and sea under various conditions is reviewed at length. Winds, especially those of the upper air, are sufficient to account for the occasional, and possibly somewhat general, extended movements of insects.

Felt (E. P.). **Three Japanese Beetles new to New York State.**—*New York State Mus. Bull.*, no. 274, pp. 131–144, 3 pls., 2 figs., 11 refs. Albany, N.Y., April 1928.

Brief accounts are given of the bionomics and control of *Popillia japonica*, Newm., *Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow, three species that have recently been found in New York State [*R.A.E.*, A, xv, 252].

Felt (E. P.). **Observations and Notes on injurious and other Insects of New York State.**—*New York State Mus. Bull.*, no. 274, pp. 145–176, 5 pls., 13 refs. Albany, N.Y., April 1928.

During recent years *Hemerophila pariana*, Clerck (apple and thorn skeletoniser) has greatly extended its range, its very general spread suggesting that winds have been the principal agents in carrying the moths over extensive areas. Observations in Albany in 1924 showed the occurrence of three generations, the larvae of the first becoming full-grown about the middle of June. By 10th August most of the second brood had made their cocoons, and adults were observed on 22nd August. Small larvae of the third brood were seen on 7th September and as late as 24th September. There was a marked decrease in the abundance of this pest in the older infested areas in 1925 and 1926. The young caterpillars feed largely on the lower surface of the leaves, especially along the midrib. When about half-grown, they move to the upper surface and attack the older leaves almost exclusively. Spraying with lead arsenate is effective against them. *Erannis tiliaria*, Harr., is present in small numbers from year to year and only occasionally attracts notice. The larvae were very injurious in 1925, but have been practically unknown for the past few years. The full-grown larvae leave the trees in June and pupate in earthen cells 5–6 inches below the surface of the soil. The moths emerge late in

October or early in November. The wingless females deposit their eggs in small clusters on or under the bark of various trees, and the young caterpillars hatch in early spring. They are frequently associated with those of *Alsophila pometaria*, Harr. (fall canker worm) and *Palaeacrita vernata*, Peck (spring canker worm), and like them are general feeders. They have a marked preference for lime, but are also frequently abundant on elm, various forest trees and apple. Soft maple and certain oaks appear to be favoured in some localities. Spraying with lead arsenate at the rate of 3 lb. powder to 100 U.S. gals. water is recommended for valuable shade and orchard trees.

The European weevil, *Phyllobius oblongus*, L., was first discovered in the United States on three American elms [*Ulmus americana*] in June and July 1923, but it was not observed in 1924. The author points out the necessity for keeping the locality under observation. *Tetralopha robustella*, Zell., was taken on Austrian pine [*Pinus laricio austriaca*] in 1923, and a parasite, *Meteorus* sp., was reared from it. *Ocnerostoma piniariella*, Zell. (European pine-needle miner) was first taken in America at Ithaca, N.Y., in 1882; it was found in needles of western white pine [*P. monticola*] in British Columbia in 1922, and it has apparently continued to exist at Ithaca since it was again taken in 1924 [*R.A.E.*, A, xiii, 177]. The greatly increased planting of white pine [*P. strobus*] has brought *Pissodes strobi*, Peck (white pine weevil) into prominence, and in certain areas at least it is a serious pest of pine trees approximately two to ten feet high. It is suggested that the interplanting of Scots pine [*P. sylvestris*], the early growth of which is rapid, would probably protect the white pine to a considerable extent. The systematic cutting and burning of infested shoots in the first half of July, or the placing of infested material in barrels covered with mosquito netting to allow the escape of parasites, would reduce the numbers of the weevils. Their systematic collection during the warm days of early spring, continued at intervals of three to five days, gets rid of them before any material damage has been done and affords a certain amount of protection for more than one season. *Olethreutes abietana*, Fern. (spruce leaf miner) was abundant in various localities in 1925. Eggs are deposited in mid-summer. *Ascogaster provancheri*, Dalle Torre, appears to be an important parasite. A related species, *Epinotia nanana*, Treitsche, was reared from infested twigs of Norway spruce [*Picea excelsa*] and hemlock [*Tsuga*]. There was also a minor infestation by *Recurvaria piceaella*, Kearf., the larvae of which mine in a similar manner in spruce. Spraying with a tobacco soap preparation at standard strength during the last half of July or with lead arsenate (4 lb. powder to 100 U.S. gals. water) during the first half of May is recommended against these miners.

Powder post beetles (*Lyctus* spp.) are recorded from woodwork in motor-cars and buildings, the trouble in every case being due to the employment of sapwood, which should be treated with some preservative before being used.

HAWKINS (J. H.). **Wireworms affecting Maine Agriculture. (A Preliminary Report.)**—*Bull. Maine Agric. Expt. Sta.*, no. 343, 20 pp., 3 figs., 6 refs. Orono, Me., February 1928.

In the central and southern farming districts of Maine the crops are heavily infested with wireworms, which have become so numerous and destructive that susceptible crops cannot be grown profitably in certain

low-lying areas, and may be affected during some years even on higher and better-drained land. The larvae, pupae and adults of *Agriotes mancus*, Say (wheat wireworm) are briefly described. The eggs, which were not observed, are laid in the soil during late spring and early summer. The larvae grow slowly and begin to hibernate at various depths in October and November. In April and May they make their way towards the surface and feed throughout the season. They again hibernate in the autumn, returning towards the surface in the following spring, and after feeding for several months, pupate during late July or August at a depth of 2–8 inches. The adults are formed in two to three weeks, but remain in the pupal cells until the following spring, when they come to the surface of the soil and emerge from their hiding places during the warm days of June for pairing. For oviposition the females seem to prefer meadows and grassy or weed-grown areas undisturbed by cultivation. This species inhabits largely the moist spots in fields, while a species of the genus *Melanotus* lives in the drier, better drained areas. It is seldom so destructive as *A. mancus*, as it does not concentrate its attack on a single plant and the injury is scattered over the entire field. Its life-cycle is apparently longer; one member of this genus has been found to have a life-cycle lasting 5 years. An outbreak of "black wireworms" reported in the late summer of 1926 was found to be due to millepedes, which are often associated with wireworms and may therefore be confused, though they are much less destructive.

Nearly all the common crops grown in Maine may be injured, but the loss occasioned to maize and potatoes is probably greater than to any other single crop owing to the large area on which these crops are grown. The injury is described. General farm practices, such as crop rotation, clean cultivation, fallowing, the use of immune or resistant crops and the judicious employment of fertilisers, are recommended as remedial measures, while baiting with sprouting wheat and subsequent fumigation with calcium cyanide has proved an effective method of control.

Fulton (B. B.) [&] Clark (R. M.). **Life History of the Apple Curculio [and Report of Progress on its Control].**—*Rep. Iowa Hort. Soc. 1925*, lx, pp. 36–42, 2 pls. Des Moines, Iowa [1926].

An account is given of the apple curculio [*Tachypterellus quadrigibbus*, Say] as occurring in Iowa, where, frequently accompanied by the plum curculio [*Conotrachelus nenuphar*, Hbst.], it causes very heavy losses to the apple crop. A lead arsenate spray applied just as the adults appear and before oviposition has begun would be very effective, but it is difficult to time the spray correctly.

The usual remedial measures, such as spraying, cultivation, and the use of pigs when available, were practised for years and for short periods seemed to reduce the damage somewhat, but though after five years *C. nenuphar* had disappeared (probably as a result of cultivation), in nine years the apple curculio was still more injurious. Complete destruction of the apples that drop in June is desirable [*R.A.E.*, A, xvi, 505], and as the expense of collection would be almost prohibitive over large areas, pigs were employed in the spring of 1925 to do the work. After all the grass in the orchards was cut during April and May, the pigs kept this down as well as eating the small, green apples as they fell. The worst areas were completely cleared by this method in about three weeks. Where grass has been destroyed by early disking, at least five

pigs to the acre are necessary to clear the ground. When infested apples were buried by ordinary disking, the beetles were able to emerge from the apple and through the ground, and cultivation after the June drop begins would prevent pigs from finding all the apples. The fence rows should be burnt along in late winter and hawthorn [*Crataegus*] near orchards should be destroyed.

TALBERT (T. J.). **Oil Emulsion Sprays : Their Place, Manufacture and Use.**—*Rep. Iowa Hort. Soc. 1925*, lx, pp. 94–102. Des Moines, Iowa [1926].

An account is given of the methods of preparing lubricating oil emulsion sprays, the physical properties of the oils and their effect on trees, foliage and fruit. It is believed that no injury will follow the continued use of 2 per cent. lubricating oil emulsions, provided that they are properly applied. Oil emulsions to the standard formulae have been used at 1 and 2 per cent. strength throughout the growing season on apple, peach, cherry and grapes, but a 2 per cent. strength produced injury when used after the cluster bud spray for apples, and also when applied to stone fruit or grapes. It is possible to use these emulsions in a combination spray with Bordeaux mixture and lead arsenate before the flower buds open. Summer applications of 1 or 2 per cent. oil have not proved satisfactory for the control of San José scale [*Aspidiotus perniciosus*, Comst.].

DAHLGREN (E.). **Some Important Greenhouse Pests.**—*Rep. Iowa Hort. Soc. 1925*, lx, pp. 187–192. Des Moines, Iowa [1926].

It is estimated that about 10 per cent. of the value of plants grown under glass in Iowa is lost owing to the attacks of insects and mites, and that much of this loss could be eliminated by prompt remedial measures. One of the most destructive pests is *Tarsonemus pallidus*, Banks (cyclamen mite), which attacks a variety of flowering plants, injuring the young leaves and finally producing a dwarfed and shrivelled plant. The life-history of the mite is briefly recorded ; its life-cycle requires 4½–6 weeks. Preventive measures are necessary against it, as fumigation is not effective. Spraying should be begun as soon as the seedling has developed two or three leaves and should be continued at least every two weeks after potting. Infested plants should be removed and burnt to prevent the spread of the mite. *Rhizoglyphus hyacinthi*, Boisd. (bulb mite) is constantly being introduced in various bulbs from other countries. The mites burrow into the roots and stems, and though capable of living in diseased bulbs, they apparently prefer sound ones. As many as 130 eggs may be laid by one female beneath the bulb scales or among the roots, and the normal life-cycle requires from 9 to 27 days, so that 10 or more generations may develop in a year. A hypopus stage sometimes develops in the nymphs and may last for several weeks. To avoid infestation it is suggested that all soft and rotten bulbs should be burnt, care should be taken in growing and fertilising the plants, and for bulbs in cold storage a temperature of about 35° F. should be maintained. The most successful treatment for infested bulbs is to immerse them for 10 minutes in a solution of 40 per cent. nicotine sulphate, 1 : 400, heated to 122° F. Hot water at 131° F. may also be used for 10 minutes, or a 2 per cent. formalin solution at 122° F. for the same time.

Paddock (F. B.). **The Spread of the Bee Moth.**—*Rep. Iowa Hort. Soc. 1925*, lx, pp. 308–312. Des Moines, Iowa [1926].

The history of the bee moth, *Galleria mellonella*, L., and of its spread through the world is briefly reviewed.

Smith (H. S.) & Compere (H.). **The Introduction of new Insect Enemies of the Citrophilus Mealybug from Australia.**—*J. Econ. Ent.*, xxi, no. 5, pp. 664–669, 1 ref. Geneva, N.Y., October 1928.

Pseudococcus gahani, Green (citrophilus mealybug) is spreading rapidly in the *Citrus* groves of California, where about 50,000 acres are at present infested. The control measures are biological, the Coccinellid *Cryptolaemus montrouzieri*, Muls., being propagated for this purpose. During the present season the 13 insectaries will produce 40,000,000 beetles at a cost of approximately £25,000. Six species of natural enemies of this mealybug were found in Australia [*R.A.E.*, A, xvi, 523] and were brought to California, where they are now being extensively propagated and colonised in the *Citrus* groves. Of these, two undescribed Chalcids of the genera *Tetracnemus* and *Coccophagus* are internal parasites ; they complete their life-cycle in about 30 days and are very prolific, developing on practically all stages of the mealybug. The Cecidomyiid, *Diplosis* sp., promises to be very effective, as it completes a generation in 12 days and increases with extreme rapidity in the insectary. Two Coccinellids, *Scymnus* (*Pullus*) and *Diomus*, though slow breeders, are likely to be of value in seeking the Coccids in their hiding places beneath bark or under leaves, where other natural enemies are unlikely to find them. *Scymnus* appeared in Australia to be especially associated with *P. gahani*, as it was seldom found with other species of mealybugs. *Chrysopa* sp. is a large voracious and extremely active predator, and it destroys other Coccids and Aphids as well. This species, which is abundant in *Citrus* groves in Australia and can be reared in large numbers in the insectary, is of particular value in attacking Coccids in winter when most of their other enemies are practically dormant. *P. gahani* is also found in New Zealand, where, however, it is evidently an introduced pest.

Swezey (O. H.). **Present Status of certain Insect Pests under biological Control in Hawaii.**—*J. Econ. Ent.*, xxi, no. 5, pp. 669-676. Geneva, N.Y., October 1928.

The present status of a number of insect pests in Hawaii, where remarkable success has been attained in their control by means of the introduction of their natural enemies from other countries, is discussed, the parasites or predators employed being enumerated in each case.

Icerya purchasi, Mask. (cottony cushion scale), originally a serious pest of fruit-trees and ornamental trees and shrubs, has ceased to be of importance owing to the introduction of *Novius cardinalis*, Muls. *Perkinsiella saccharicida*, Kirk. (sugar-cane leafhopper), originally the most destructive pest in Hawaii, is now hard to find in most of the sugar-cane area, and when it occasionally appears is quickly controlled by the egg-sucking bug, *Cyrtorhinus mundulus*, Bredd., the most effective of the numerous natural enemies introduced against it. *Rhabdocnemis obscura*, Boisd. (sugar-cane weevil borer), though largely controlled by the New Guinea Tachinid, *Ceromasia sphenophori*,

Vill., introduced in 1910, is still causing up to 30 per cent. infestation of the canes and heavy financial losses in some places where conditions are particularly favourable to it.

The spread of *Anomala orientalis*, Waterh., has been checked by the introduction of *Scolia manilae*, Ashm., from the Philippines, and it has entirely ceased to be injurious. *Cirphis unipuncta*, Haw., and *Spodoptera mauritia*, Boisd., are so well controlled by a number of parasites introduced from various places that outbreaks seldom occur and are never of importance. *Pseudococcus nipae*, Mask. (avocado mealybug) was practically exterminated within two years from the introduction from Mexico in 1922 of *Pseudoaphycus utilis*, Timb., while *Pseudococcus boninsis*, Kuw. (grey sugar-cane mealybug) is completely controlled by *Pseudococcobius terryi*, Fullaway. The latter does not, however, attack *Trionymus sacchari*, Ckll. (pink sugar-cane mealybug), which is generally prevalent in all cane fields, though not rated as a serious pest. *Anagyrus dactylopii*, How., was introduced in 1925 from Hongkong against *Pseudococcus filamentosus*, Ckll. (cotton mealybug), which has already become scarce and is likely to become as well controlled as *P. nipae*. Aphids are fairely well controlled by introduced Coccinellids.

About 55 per cent. of the larvae of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) are destroyed by a number of introduced parasites, and *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., is controlled to a slightly greater extent by *Opius fletcheri*, Silv., introduced from India in 1916. By the combined work of a number of parasites several Bruchids, *Bruchus prosopis*, Lec., *B. sallaei*, Sharp, *B. amicus*, Horn, and *Pachymerus gonager*, F., feeding on algaroba pods are sufficiently controlled to protect the pods from serious injury, the egg parasite, *Uscana semifumipennis*, Gir., being probably the most effective.

PARKER (W. B.). **The Bud Mite (Blister Mite) of the Pear.**—*J. Econ. Ent.*, xxi, no. 5, pp. 676–677. Geneva, N.Y., October 1928.

This paper records observations [in California] on mites causing the destruction of many pear buds, which while resembling *Eriophyes pyri*, Pagst. (pear-leaf blister-mite) differ from it in habits and are not susceptible to spraying with lime-sulphur by which it is controlled. Dead and injured fruit buds were found infested with mites and eggs at blossom time, most of the infested buds being killed. After consuming the buds, the mites migrated to the bracts at the bases of the new shoots and later to the tender growth, keeping inside the unfolding leaves. Only a few were found on the blossoms and young fruit. They migrated upward as the twig developed and worked in the new buds forming in the axils of the last formed leaves, but well down where they were protected, as many as 80 being found on one bud. When the fruit buds developed and the bud scales loosened, the mites were found working down inside the first bud scales. Eggs were present until the end of June and were observed again on 1st September, none being found in July or August. On 10th October the mites had not penetrated further than the inside of the first bud scales, but by the middle of November they had worked inside the second layer. Buds taken from twigs blistered by *E. pyri*, on the other hand, contained numerous mites that had worked beneath the scales on 10th October. The absence of eggs among these mites is a further point of difference between them and the bud blister mites, which were also found on trees with no leaf blisters. Some mites were killed in experiments with 1 per

cent. lime-sulphur, 1–4 per cent. Volck oil and dusting sulphur applied when the new growth had reached a temporary limit and the mites, though protected, were more exposed than at any other time, but not enough to constitute a satisfactory control.

Gilmore (J. U.) & Milam (J.), U.S. Bur. Ent. **Control of the Green June Beetle in a Tobacco Field.**—*J. Econ. Ent.*, xxi, no. 5, p. 677. Geneva, N.Y., October 1928.

An outbreak of *Cotinis nitida*, L. (green June beetle) is recorded for the first time in the dark tobacco belt. The infestation was heavy, varying from 4 to 12 larvae to the hill; the first planting had been destroyed, and the replants were being destroyed when remedial measures were undertaken. Excellent control was secured by the application at the rate of 30 lb. to the acre of a bait of 25 parts coarse wheat bran and 1 part Paris green, moistened with water. Replanting was resumed two days after treatment, and a normal stand of tobacco was obtained.

Woglum (R. S.) & La Follette (J. R.). **A Unit System for recording the Results of Insecticides against the Citrus Black Scale.**—*J. Econ. Ent.*, xxi, no. 5, pp. 678–682. Geneva, N.Y., October 1928.

In order to determine the comparative values of numerous insecticides used against *Saissetia oleae*, Bern. (citrus black scale), a unit method of inspecting *Citrus* has been devised. The unit selected was a scale-bearing branch 6–10 inches long, the average number of mature scale to each of these branches giving the unit rating of the tree. Five units to a tree is considered a minimum for making accurate records. In a ten-acre block 200 units are taken from 40 trees selected so as to include all parts of the orchard, the rating of which is obtained by dividing the total number of scale found by the total units. A knowledge of the habits of the scale and of certain other factors is necessary in order to secure accurate results. In the interior valleys of California *S. oleae* is largely confined to the northern or shady side of the tree, from which the units are therefore selected. In some orchards where the scale is settled on the twigs by February, new growth occurs subsequently, and false results would be obtained if outside twigs were selected indiscriminately. In the case of fumigated trees, the scale kill is much the same throughout the entire tree, so that five units taken from the bottom half of the tree show accurately the condition of the whole. Where sprays are used, the tops of the trees are apt to be less thoroughly sprayed, so that ground inspection, while indicating the actual value of the insecticide, does not necessarily record the severity of infestation. In such cases the only accurate method is to inspect both tops and bottoms of the trees and record the results separately.

Ryan (H. J.). **District Argentine Ant Control in Citrus Orchards.**—*J. Econ. Ent.*, xxi, no. 5, pp. 682–690, 4 refs. Geneva, N.Y., October 1928.

The following is taken mainly from the author's summary: Although an effective poison syrup formula for the control of *Iridomyrmex humilis*, Mayr (Argentine ant) in California has been known for some

years [*R.A.E.*, A, viii, 115], the individual citrus-grower has been able to make no headway towards eradication or even adequate control for any considerable length of time because of renewed infestations from untreated properties. A co-operative financing plan has now made it possible to treat all infested orchards over an area of 45,000 acres in Los Angeles County, treatments being applied in October and April each year. A new, cheap, paper poison-container has been developed, and the cost of application reduced to about one penny for each container. Detailed costs and figures are given for all operations. Two years' work in 14,200 acres of orchard has resulted in a reduction of 50 per cent. in the number of infested properties, and a decrease of 83 per cent. in the number of containers needed to control the remaining infestations.

DE ONG (E. R.). **Specifications for Petroleum Oils to be used on Plants.** —*J. Econ. Ent.*, xxi, no. 5, pp. 697–702, 4 refs. Geneva, N.Y., October 1928.

This paper defines characteristics for evaluating petroleum lubricating oils that have taken the place of the older specifications, such as flash point, colour and gravity, now proved to be of little value for defining oils suitable for spraying purposes. Laboratory methods for determining these characteristics are described in detail. Two or more characteristics are required to define an oil, no single specification being sufficient to describe oils suitable for use, particularly on foliage. Sulphonation value, in connection with volatility and viscosity, and perhaps stability, as shown by the oxidation test, are all of value.

Petroleum oils for use on foliage at summer temperatures should, according to experimental results in California, have an unsulphonatable residue of 88–99 per cent., the lower percentage being only permissible with oils of low viscosity, 40–50 seconds Saybolt, and decidedly volatile. These oils should be stable chemically and not oxidise readily. Oils for foliage use at low temperatures (maximum daily temperature 45–60° F.) may be of a more viscous and less volatile form, thus reacting for a longer period of time. Oils for dormant use on deciduous trees should have an unsulphonatable residue of 65–75 per cent. and a viscosity of 85–120 seconds Saybolt. There is apparently less danger from oxidation products in oils for use on dormant trees than in those for foliage use at comparatively high summer temperatures. Lower insecticidal value resulting from the use of highly refined oils may be compensated for in part by incorporating other and more active chemicals, such as nicotine. Specially refined pine oils may also be found useful as solvents for nicotine blends with petroleum oils, particularly for *Citrus*.

EYER (J. R.) & ROBINSON (F. M.). **The Effect of certain hard Waters on the Stability of cold mix lubricating Oil Emulsions.**—*J. Econ. Ent.*, xxi, no. 5, pp. 702–707, 2 graphs, 1 ref. Geneva, N.Y., October 1928.

In an attempt to ascertain the cause of the separating out of cold mix oil emulsion stocks on dilution with certain of the hard waters of New Mexico, it was found that a modification of Herschell's demulsibility test could be applied for determining the rate of separation of these mixtures. In the modified form of this test, a quantity of emulsion

stock sufficient to separate out 4 cc. of oil and 96 cc. of water and emulsifier, was placed in a 100 cc. graduated cylinder and stirred for 5 minutes with a standard paddle running at 1,500 r.p.m. A small quantity of an oil-soluble dye was added to facilitate the readings, which were made at 70° F. The rate at which the oil settles out from the emulsion when allowed to stand at this temperature is the measure of the emulsibility of the oil and an index to the stability of the emulsion, and the rate of settling out expressed in 60 seconds is called demulsibility. This test, when applied to oil emulsions made from hard waters containing magnesium sulphate in amounts greater than 5 per 100,000, showed that demulsibility was in proportion to the amount of magnesium sulphate present, leading to the conclusion that this chemical was largely responsible for the instability of the emulsions in the types of water observed. Calcium sulphate and sodium chloride, also normal constituents of New Mexico hard waters, did not affect the stability of emulsions.

Woglum (R. S.). **Climatic Influence on Citrus Insect Distribution in California.**—*J. Econ. Ent.*, xxi, no. 5, pp. 708–715, 1 chart. Geneva, N.Y., October 1928.

Pests of *Citrus*, which occur in California in more or less defined areas, are classified from the standpoint of climatic adaptation in three groups. Those adapted to the mild environment prevailing in the coastal area are the purple scale [*Lepidosaphes beckii*, Newm.], the citrophilus mealybug [*Pseudococcus gahani*, Green] and the common mealybug [*P. citri*, Risso]. Those adapted to a hot dry environment, such as prevails in the interior valleys of the northern *Citrus* area, are the citricola scale [*Coccus pseudomagnoliarum*, Kuw.], the citrus thrips [*Scirtothrips citri*, Moult.] and possibly the yellow scale [*Chrysomphalus aurantii citrinus*, Coq.]. Those adapted to the both mild and moderately hot environment that characterises the interior southern areas are the black scale [*Saissetia nigra*, Nietn.], the red scale [*C. aurantii*, Mask.], the citrus red spider [*Tetranychus citri*, McGregor] and the citrus aphis [*Aphis pomi*, DeG.]. A comparison of the distribution of these pests in 1927 and 1907 shows that the established major pests have spread little beyond their original limits, the greater areas infested being due to new planting within territory previously infested. More recently discovered pests, on the other hand, have rapidly extended their distribution until they reached their climatic limitations. An attempt is made to designate the maximum temperatures and minimum humidities that appear to limit the destructiveness of the more important of these insects.

Boyce (A.M.). **Studies on the Resistance of certain Insects to Hydrocyanic Acid.**—*J. Econ. Ent.*, xxi, no. 5, pp. 715-720, 4 refs. Geneva, N.Y., October 1928.

Instances of the increased resistance of insects to insecticidal treatments, taken from the literature, are briefly reviewed, and a report is given on experiments carried out with a view to producing, through continued artificial selection, a strain of insects more resistant to hydrocyanic acid gas than were the original parents. *Drosophila melanogaster*, Mg. (vinegar or pomace fly) was chosen for use in one of these experiments, as being easily handled and reared, very prolific,

and reproducing sexually. The last feature is of value because of the possibility of resistance to the gas being inherited according to Mendelian laws, in which case it might be sex-linked in its transmission. The dosage of gas that would consistently kill a high percentage of flies was used in a gas-tight fumigatorium of 10 cu. ft. capacity. The standard amount used was 2·5 cc. liquid HCN and the period of exposure was 45 minutes. After 12–15 hours the surviving flies were counted and the number of each sex noted. Cultures of the flies surviving each treatment were set up for reproduction. The flies of each filial generation were fumigated together with a check of stock flies reared under like conditions. Seven generations have so far been reared and fumigated, and the results hitherto obtained indicate that an increasing degree of resistance develops through continued selection.

Experiments on similar lines were also carried out with *Aphis gossypii*, Glov., which breeds rapidly and reproduces parthenogenetically under controlled temperatures. The standard found to be satisfactory in this case was 3 cc. of liquid HCN with an exposure of 30 minutes. Although the data secured in this experiment tend to show that a slight degree of resistance is developed through selection, in one test (the third) a much larger percentage of the controls survived than of the selected strain.

Similar experiments are being carried out on beetles that infest stored products and on citrus Coccids, but the data are not yet sufficient to be presented.

HAMNER (A. L.). **Predicting serious Cotton Aphis Infestations.**— *J. Econ. Ent.*, xxi, no. 5, pp. 736–741. Geneva, N.Y., October 1928.

Serious infestations of the cotton aphis [*Aphis gossypii*, Glov.] have occasionally followed applications of calcium arsenate against the boll weevil [*Anthonomus grandis*, Boh.], and a rapid increase has been observed in such infestations after they had reached 10 per cent. of the cotton crop. The results of experiments in 1927 indicate that when an infestation as high as 5 per cent. exists at the time calcium arsenate dusting is started, a heavy infestation may be expected if four applications are made. Infestations varying from 13 to 16 per cent. at the time when dusting was stopped produced serious infestations but additional applications after this percentage was reached did not affect the infestation to any extent. No satisfactory results were secured from the application of $7\frac{1}{2}$ per cent. nicotine sulphate dusts.

HINDS (W. E.). **The Effect of the Spacing of Cotton upon the Form and Height of the Plant.**— *J. Econ. Ent.*, xxi, no. 5, pp. 741–748. Geneva, N.Y., October 1928.

This paper records the results of tests carried out from 1924 to 1926 on Mississippi River bottom soil to determine the effect of spacing of cotton upon the yield secured, particularly under conditions of infestation by the boll weevil [*Anthonomus grandis*, Boh.]. Previous tests have shown that in practically all cases it was advisable to plant the rows as closely together as possible with due allowance for the normal height of the plants and the culture required, and also to leave the plants much thicker in the row than had hitherto been the custom. In the tests described, hill spacing with 3–5 stalks at 1–2 ft. apart appeared to be the most practicable and desirable.

Lyle (C.). **Poisons for Cutworm Baits.**—*J. Econ. Ent.*, xxi, no. 5, pp. 748–750. Geneva, N.Y., October 1928.

Laboratory tests against *Agrotis ypsilon*, Rott. (greasy cutworm), *Laphygma frugiperda*, S. & A. (southern grassworm) and a few individual specimens of *Prodenia ornithogalli*, Guen. (yellow striped army-worm) indicated that Paris green is more rapid in its action and considerably more toxic than sodium fluosilicate, when used in poison baits at the rate of 1 lb. to 50 lb. wheat bran, with enough water to make the bran thoroughly moist, but not sloppy. Against *A. ypsilon* 98 per cent. mortality was secured with Paris green in 24 hours and 100 per cent. in 48 hours, the corresponding percentages in the case of *L. frugiperda* being 87·3 and 97·2 per cent. The results secured with sodium fluosilicate were 70 and 83·4 per cent. in the case of *A. ypsilon* and 47·5 and 64·4 per cent. in that of *L. frugiperda*.

Drinnan (D. E.). **Billing Yard Inspection of Nursery Stock.**—*J. Econ. Ent.*, xxi, no. 5, pp. 750–752. Geneva, N.Y., October 1928.

This paper deals with three different types of inspection of nursery stock, that most used being field inspection, the purpose of which is to detect insects and diseases during the growing period and to control them. When used alone, this type of inspection is often inadequate, as it fails to detect infestations of the root system, and subsequent infestations are liable to develop in stock inspected several months before being offered for sale. The importance of inspection on delivery of plants at their destination, and of billing yard inspection, which is given when they are about to be shipped, is emphasised. The best results, however, are secured by a combination of all three types of inspection.

Snow (S. J.), U.S. Bur. Ent. **Effect of Ovulation upon Seasonal History in the Alfalfa Weevil.**—*J. Econ. Ent.*, xxi, no. 5, pp. 752–761, 6 figs., 1 ref. Geneva, N.Y., October 1928.

Larvae of *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.) (alfalfa weevil), the life-history of which under the climatic conditions of the Great Basin is briefly indicated, occur sparingly throughout the summer after a great number have become adults, although not in sufficient numbers to injure the third and fourth lucerne crops upon which they are found. Studies have been made to determine whether these larvae belong to a second generation, which might, under other climatic conditions, become injurious. For this purpose the reproductive organs of female beetles of all ages were dissected and examined. A survey of the growth of a generation of female weevils throughout two seasons of their existence shows that adults emerging in the spring and summer remain immature for about four months at least after emergence, that is until late September or October of their first season. About half of these appear to be capable of oviposition by the time winter sets in. Weevils found hibernating in sheltered places, such as hedges and ditches, develop more slowly, showing no egg development even in winter and early spring. The few eggs found in August and September may be accounted for by the small number of females of the previous season that survive till the end of their second summer.

These eggs and the larvae that come from them are therefore retarded members of the old generation and not a partial new brood. The cool temperatures prevailing in the inter-mountain country would prevent the larvae produced from eggs deposited by beetles maturing in the autumn from hatching in sufficient numbers to be of importance.

CARTER (R. H.) & ROARK (R. C.). **Composition of Fluorides and Fluosilicates sold as Insecticides.**—*J. Econ. Ent.*, xxi, no. 5, pp. 762–773. Geneva, N.Y., October 1928.

The following is the authors' abstract of this paper: Samples of fluorides and fluosilicates representing the products of 14 manufacturers in the United States were examined chemically and microscopically. Both of these materials may be obtained in a satisfactory degree of purity. In solution all the fluosilicates give an acid reaction; whereas the sodium fluorides show a neutral or alkaline value. It is believed that the observed variations in the apparent toxicity to insects of different brands of commercial sodium fluosilicate are owing to factors other than variations in fluorine content. Variations in size of crystals cause variations in cubic inches per pound, dusting qualities, adhesiveness, and rate of solution, properties which greatly influence the efficacy of a dust insecticide. Variations in foliage-scorching properties of different brands of commercial sodium fluosilicate are likewise probably the result of variations in size of the crystals.

HEADLEE (T. J.). **An Operation in practical Control of Codling Moth in a heavily infested District. Second Report.**—*J. Econ. Ent.*, xxi, no. 5, pp. 774–778. Geneva, N.Y., October 1928.

As the result of continued organised efforts carried out in New Jersey against *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth), the percentage of apples free from injury, which amounted to only 50 per cent. in 1925, has been increased from 68·8 per cent. in 1926 [*R.A.E.*, A, xv, 259] to 82·1 per cent. in 1927. Delayed dormant treatment consisted in 1927 of one part commercial lime-sulphur to 9 parts water containing 40 per cent. nicotine sulphate, 1 : 500, where apple Aphids were present, otherwise an oil emulsion at the rate of 4½ gals. to 95½ gals. water was applied. The pink bud spray was composed of lime-sulphur, 1 : 40, to which in some cases lead arsenate was added at the rate of 1½ lb. to 50 U.S. gals. The blossom-fall spray generally consisted of either New Jersey dry-mix sulphur-lime or commercial lime-sulphur, 1 : 40, with lead arsenate at the same rate. The amount of infestation was not appreciably greater for the omission of lead arsenate from this spray in a few cases. Where dry-mix was used, enough additional adhesive was incorporated in the spray to give a total of 3 lb. to 100 U.S. gals., a formula that was also used for the spray 7 days after blossom-fall. That 17 days after blossom-fall was in most cases the same, but where heavy injury was anticipated the amount of lead arsenate was increased to 2 lb. This was the last spray given in some orchards, additional treatment for first brood larvae consisting of dusting with a mixture of 85 per cent. elemental sulphur and 15 per cent. lead arsenate. In a few instances where a later cover spray was given to early fruit, the amount of lead arsenate was reduced to 1½ lb. to 50 U.S. gals., no additional adhesive being incorporated. Later cover sprays applied to late apples against first brood larvae as soon as the film coating

established by the 17-day spray had been broken, consisted of dry-mix 2 lb. lead arsenate to 50 U.S. gals. water and enough additional adhesive to increase the total to 3 lb. to 100 U.S. gals. spray. A similar mixture, but with a reduced amount of dry-mix, was sometimes applied against second brood larvae, and in some orchards a second cover spray was applied when the film established was broken, consisting of a reduced amount of dry-mix, 1½ lb. lead arsenate, and 50 U.S. gals. water.

Although the timing, composition and methods of applying insecticide materials are dominant factors in obtaining good results, orchard sanitation measures are minor but important items in controlling infestations of *C. pomonella*.

LEONARD (M. D.). **The European Corn Borer Clean-up Campaign in New York State, 1927.**—*J. Econ. Ent.*, xxi, no. 5, pp. 778–783. Geneva, N.Y., October 1928.

During the spring of 1927 a compulsory clean-up campaign against *Pyrausta nubilalis*, Hb. (European corn borer) [*cf. R.A.E.*, A, xvi, 391, etc.] was carried out in a area including parts of three counties in western New York. The organisation and methods employed in an educational campaign carried on throughout the whole of the more heavily infested part of the State are briefly described, the area under regulation is delimited and the policies involved explained.

HAMLIN (J. C.) & REED (W. D.), U.S. Bur. Ent. **Some macroscopic Effects resulting from the Fumigation of *Plodia* Larvae with Carbon Disulphide in Relation to Revival Potentialities.**—*J. Econ. Ent.*, xxi, no. 5, pp. 783–788. Geneva, N.Y., October 1928.

The following is taken from the authors' abstract of this paper: Full-grown larvae of *Plodia interpunctella*, Hbn. (Indian-meal moth) revived from one to two weeks after fumigation with carbon bisulphide at the rate of 2 lb. to 1,000 cu. ft. in the latter part of October. During the period of inactivity between fumigation and revival, larvae that may possibly revive may be detected with considerable accuracy by their retention of a nearly normal colour and a fair degree of turgidity, and by their not being severely shrivelled. Among such individuals, however, one cannot determine which or what percentage will later become fully resuscitated. Congestion of the intestinal tract is a common condition of reviving larvae and is operative in causing the subsequent death of some of them. A few larvae that revived from a 6-hour exposure developed to adults.

HAZELHOFF (E. H.). **Carbon Dioxide a Chemical accelerating the Penetration of respiratory Insecticides into the tracheal System by keeping open the tracheal Valves.**—*J. Econ. Ent.*, xxi, no. 5, p. 790, 3 refs. Geneva, N.Y., October 1928.

During studies of the regulation of respiration of insects, it was observed that the spiracles of *Periplaneta americana*, L., which displayed no respiratory movements when at rest at room temperature, opened immediately when the insect was brought into an atmosphere containing 2 or 3 per cent. carbon dioxide, thus allowing a more rapid diffusion of the respiratory gases. When the carbon dioxide pressure

was raised to about 7–10 per cent. or more ordinary respiratory movements of the abdomen reappeared. The width of the spiracle opening appeared to be normally regulated by the amount of carbon dioxide diffusing out of the tracheal system, the tracheal valves opening more and more widely when metabolism was increased by a rise in temperature. Since a similar effect was produced on several other insects of different orders, it seems probable that the penetration of respiratory insecticides into the tracheal system may be accelerated by the application of a small amount of carbon dioxide. Thus the insecticidal action of a definite concentration of a fumigant might be increased, or the same effect might be obtained by a lower concentration or a shorter exposure. It seems probable that the increased susceptibility of insects to hydrocyanic acid at higher temperatures, as observed by Brinley and Baker [*R.A.E.*, A, xvi, 95], is to be explained by the influence of increased metabolism, and therefore of increased output of carbon dioxide, upon the width of the spiracle opening.

Schwing (E. A.). **Experiments on Control of** *Eutettix tenellus* **(Baker).** —*J. Econ. Ent.*, xxi, no. 5, pp. 790–791. Geneva, N.Y., October 1928.

An account is given of the results secured in several months' experiments in the control of *Eutettix tenella*, Baker, in California, with emulsions consisting of varying dilutions of a proprietary oil fly-spray and whale oil soap. With an emulsion consisting of 25 parts spray and 75 per cent. soap diluted with 19 parts water, a kill of 100 per cent. was obtained in one hour with a ground temperature of 110° F. in cages under field conditions, while a 97 per cent. kill was secured at 94° F. With a similar emulsion diluted with 39 parts water a 92 per cent. kill was obtained in 5 hours. In another cage, 50 untreated leafhoppers were all alive at the end of 5 hours, but plain water sprayed on a cage of leafhoppers at 110° F. resulted in a 94 per cent. mortality at the end of 2 hours. High humidity near the ground appears to be fatal to the insect when combined with a high temperature, and this probably explains the effect of rain in the inter-mountain country in late spring and early summer.

Continuous observations over a period of nine years in the San Joaquin Valley indicate that *E. tenella* may be controlled under foothill conditions by trapping on pre-irrigated patches of sugar-beet of 5 acres each and a mile apart and killing these leafhoppers over a period of 4–5 weeks. The leafhoppers can be easily trapped in the autumn, when they move towards the foothills in search of green vegetation, though heavy rains in September and October, which have, however, occurred only once since 1918, would nullify such a programme. A 50 per cent. reduction in the numbers of *E. tenella* present in the autumn might change a prospective severe infestation into a moderate one and would enable the spray programme in the beet fields to be reduced.

Patch (E. M.). **The Foxglove Aphid on Potato and other Plants.**— *Bull. Maine Agric. Expt. Sta.*, no. 346, pp. 49–60, 3 pls. Orono, Me., July 1928.

In Maine, the foxglove aphis, *Myzus pseudosolani*, Theo., deposits over-wintering eggs on the garden foxglove (*Digitalis purpurea*) during

late September and October. These eggs hatch in the spring and the stem-mothers shelter in the folded young leaves. About one month later the next generation appears ; these early forms do little damage to foxgloves and usually pass unnoticed. The Aphids of the third generation acquire wings from June onwards and fly to other food-plants, where both winged and wingless forms develop, the former deserting the parent colonies for other plants. The food-plants are numerous, and a list of 71 species, belonging to 31 families, is given. In late summer the return migration begins, and in September and October wingless males and oviparous females are again found on foxglove. In a cold climate the Aphids cannot withstand the winter except in the egg stage, but in warmer places they could probably breed throughout the year, and they do so in greenhouses, where they are frequently found. The foxglove occurs in America only as a garden plant, or a casual escape from gardens. A number of feeding experiments are described, in which potato proved a very acceptable plant on which the Aphids multiplied rapidly. The author also observed this Aphid on foxglove in England, from which country it was originally described on potato [*R.A.E.*, A, x, 414].

PHIPPS (C. R.). **The Chain-dotted Measuring Worm. A Blueberry Pest.**—*Bull. Maine Agric. Expt. Sta.*, no. 345, pp. 34–48, 2 pls., 23 refs. Orono, Me., May 1928.

Cingilia catenaria, Drury (chain-dotted measuring worm) is recorded for the first time as a serious pest of blueberry in Maine. An account of the history and distribution of the moth is given, and all its stages are described. It attacks a large range of plants [*R.A.E.*, A, xiii, 497], a list of 47 being given. The greatest economic loss is caused to blueberry, blackberry and cranberry, but if the larvae are abundant and food is scarce, they will attack almost every green plant. There is one generation a year in Maine. The emergence of adults begins about the middle of September and continues until the middle or end of October. The eggs are laid singly on the lower surface of leaves or twigs, sometimes dropping from them to the ground ; the moths appear to prefer sweet fern (*Myrica asplenifolia*) for oviposition. The largest number of eggs laid by one individual was 257, and the moth in question had undoubtedly deposited some eggs before capture. Hibernation takes place in the egg stage, and the larvae probably emerge about the beginning of June. Pupation takes place in a cocoon of loose network, the adults emerging in 3 or 4 weeks ; a few pupae were seen in the fields on 18th August. The larvae generally feed on low ground, but if infestation is heavy, migrate to high land. The author believes that *C. catenaria* has been increasing in numbers for several seasons and that the highest peak of infestation has not yet been reached, since although parasites were quite numerous in 1927, disease was of little importance.

An observation in one locality indicated that control may be obtained by the use of 1 to 1½ lb. lead arsenate in 50 U.S. gals. water ; when the larvae had stripped nearly every green plant in a low-lying pasture and were about to migrate into an adjacent blueberry field, the spray was applied to a narrow strip along the edge of the field just in front of them. The morning after the application some larvae were dead, and after a further 24 hours, all those in the sprayed area were dead or inactive.

The parasites bred during 1927 were the Tachinid, *Madremyia saundersi*, Will., the Braconid, *Meteorus datanae*, Mues., from the cocoons of which the secondary parasites, *Hemiteles tenellus*, Say, and *Mesochorus luteipes*, Cress., have been reared, and the Ichneumonid, *Pimpla* (*Itoplectis*) *conquisitor*, Say. *M. datanae* was the most abundant parasite during the season attacking 5 to 10 per cent. of the host larvae ; cocoons were first noticed on 18th August, and the pupal period appears to last a week or ten days.

Driggers (B. F.). **Galls on Stems of cultivated Blueberry** (*Vaccinium corymbosum*) **caused by a Chalcidoid,** *Hemadas nubilipennis*, **Ashm.**—*J. N. Y. Ent. Soc.*, xxxv, pp. 253–259. New York, N.Y., September 1927.

Only 5 species of Chalcids were reared during the summer of 1926 from reniform galls, which are usually attributed to the Cynipid, *Solenozopheria vaccinii*, Ashm., formed on cultivated blueberries (*Vaccinium corymbosum*) in New Jersey the previous summer. One of these species, *Hemadas nubilipennis*, Ashm., which was much the most numerous, oviposited freely in the young growing stems of these plants in the latter half of May, *Decatoma* sp. being observed to deposit eggs only in stems attacked by *Hemadas*. In controlled cage experiments, in which separate sets of the plants were exposed to the different species of Chalcids, it was found that *H. nubilipennis* is capable of forming these galls, the other Chalcids being either parasites or inquilines. There was, however, an indication that *Decatoma* sp. may produce galls.

Annual Letter of Information, no. 40.—*U.S. Dept. Agric., Fed. Hortic. Bd.*, S.R.A., no. 93 (Suppmt.), pp. 165–224. Washington, D.C., August 1928.

This is a list of pests intercepted on imported plants and plant products from 1st January to 31st December 1927.

Johnson (C. W.). **The New England Siricidae or Horntails.**—*Bull. Boston Soc. Nat. Hist.*, no. 49, pp. 3–7, 1 pl., 3 refs. Boston, Mass., October 1928.

Brief notes are given on 7 species of Siricids found in New England, and *Sirex edwardsi*, Brullé, is recorded as occurring in numbers on Nantucket Island, infesting pines (*Pinus rigida*) that had been severely injured by *Rhyacionia* (*Evetria*) *frustrana*, Comst.

Corkins (C. L.). **The Use of Calcium Cyanide in the Apiary.**—*Bull. Wyoming Agric. Expt. Sta.*, no. 158, pp. 109–116. Laramie, Wyo., April 1928.

Calcium cyanide "G" [*R.A.E.*, A, xiv, 444] was found to be effective in the apiary for killing bees infected with American foulbrood (as the first step in the burning treatment), for the destruction of wild bees, for the fumigation of stored combs infested with larvae of the wax moth [*Galleria mellonella*, L.], and for the extermination of mound-building ants. If the supers infested with *G. mellonella* are fairly airtight, they may be stacked with a telescope cover at the top

and bottom and treated for 24 hours with calcium cyanide at the rate of 4 lb. to 1,000 cu. ft. of space. If fumigation is carried out in a fairly air-tight room with the supers stacked criss-cross, half this amount of calcium cyanide may be used. When destroying ants, one or two spadefuls should be removed from the top of the mound, two to three tablespoons of calcium cyanide sprinkled over the bottom of the pit and the earth from the mound thrown over it. The process may have to be repeated a week later. The cyanide may be more effectively applied with a hand duster by forcing the dust into holes made in the runways of the nests, and subsequently closing the holes. If the nests occur actually in the apiary, the colonies of bees should be moved several feet to prevent the bees being overcome by the gas. Experiments showed that calcium cyanide fumigation does not poison honey.

Watson (J. R.). **Report of the Entomologist.**—*Rep. Florida Agric. Expt. Sta. 1926–27*, pp. 43R–49R. Gainesville, Fla. [1928].

In further studies of *Aphis pomi*, DeG. (*spiraecola*, Patch) on *Citrus* in Florida [*cf. R.A.E.*, A, xv, 585, etc.], it was observed that eggs laid on sand pear during November–December began to hatch on 18th January. This is the first time that the eggs have been known to hatch in Florida, and shows that cold will not exterminate the Aphids. Extreme heat in summer delays both growth and reproduction, though not to the same extent as cold ; it therefore follows that severe outbreaks of the Aphids will almost always be confined to early spring, especially after a warm, moist winter followed by a cold or dry spring. A study of the insects predacious on the Aphid [xvi, 269] has led to the conclusion that the maximum consumption of Aphids (about 10 per cent.) is not enough to check an outbreak when temperature and food conditions are favourable, but is of considerable value when other factors are unfavourable, in clearing up any infestation left after spraying, or in delaying re-infestation. It is important to choose such insecticides as tobacco products, which do not kill many predators. The necessity for a thorough campaign against the Aphids during the winter and for hastening the spring growth by fertilisation and cultivation is emphasised. Among many insecticides tried, two seem to be an improvement over the 3 per cent. nicotine sulphate and lime dust hitherto used. It was found that by making this dust with sulphur in place of half the hydrated lime, a very light dust was obtained that worked well in the dusting machines. Under favourable conditions a 2 per cent. dust was effective and would considerably reduce the cost. This also kills mites. Fine tobacco dust, analysing 2 per cent. nicotine (snuff no. 2), was also promising [xvi, 197]. Against *Frankliniella tritici bispinosa*, Morg. (Florida flower thrips), causing a heavy infestation on strawberries, various insecticides were tried. Derrisol (1 : 800) was useless, killing only about 10 per cent. of the insects ; nicotine sulphate spray (1 : 800) killed nearly 90 per cent., but the best results were obtained with equal parts of sulphur and the snuff no. 2, which killed the thrips in blossoms and acted as a repellent, delaying re-infestation for several days.

Lixophaga [*diatraeae*, Towns.], the Tachinid parasite of the sugar-cane borer [*Diatraea saccharalis*, F.], has been introduced from Cuba, and some adults have already been liberated. In order to guard

against introducing secondary parasites, the pupae are kept in a cage from which they cannot escape. Pecans were heavily infested by *Cydia* (*Laspeyresia*) *caryana*, Fitch. It was found that ploughing in the fallen husks, especially in heavy soils, was very beneficial; this should be done thoroughly, between the end of harvest and the middle of February, as adults emerge from 15th February onwards. Larvae are sometimes found in hickory nuts and in galls of *Phylloxera*. Larvae of the spring generation of the nut case-bearer [*Acrobasis caryae*, Grote] were found entering nuts on 13th May. In the laboratory they were observed merely to prise open and discard the outside of the nut. Larvae placed on heavily sprayed nuts entered these and developed into adults without apparent injury from the spray; each larva entered an average of two sprayed nuts. From 80 to 90 per cent. of the leaf case-bearer [*A. nebulella*, Riley] were killed by lead arsenate sprays, according to the strength used. Numerous egg punctures of *Oecanthus angustipennis*, Fitch (tree cricket) were found in small branches of pecan, which sometimes resulted in killing the twig and sometimes left a scar that lasts for 3 years or more. In other respects this is a beneficial insect, as the food of the nymphs consists principally of Aphids.

BALDUF (W. V.). **Notes on the Habits of** *Aphiochaeta aletiae*.—*Ohio J. Sci.*, xxviii, no. 5, pp. 237–245, 4 figs., 13 refs. Columbus, Ohio, September 1928.

A survey of the economic literature on the Phorids since 1913, which is summarised, shows that these flies, particularly *Megaselia* (*Aphiochaeta*) spp., vary in habits from scavengers on plant and animal remains to true parasites of insects and higher animals.

On 25th June 1925, a larva of the Noctuid, *Achatodes zeae*, Harris (spindle stalk borer), collected on elder in Ohio was found bearing on the upper surface of its abdomen 50 irregularly laid eggs of *M.* (*A.*) *aletiae*, Comst., and several minute larvae. Hatching seemed to be distributed over several days. By 27th June all the eggs were empty, and half-grown larvae were present, the weather being hot and growth rapid. On the next day all the larvae that were alive left the back of the caterpillar. Ten were seen to enter its rectum, which they frequently left and re-entered, by way of the anus. Only four reached maturity; most of the remainder probably died of starvation. The last three abdominal segments of the caterpillar were emptied of their contents by the fly larvae, only small amounts of fat body being left adhering to the body wall. Anterior to this region the contents were undisturbed. The mature larvae left their host, which was full-grown or nearly so when first discovered and which died 7 days afterwards, and secured themselves to its tunnel. The first pupa was seen on 2nd July, and the fourth on 6th July. A single adult emerged from these on the 13th. All stages are described, and evidence is given to show that the caterpillar was probably in a diseased condition when selected by *M. aletiae* for oviposition, the fly thus exhibiting the habits of a specialised scavenger.

Achatodes may not be a necessary source of food for *M. aletiae*, although the latter's ability to find a borer in a stem with few openings suggests a regular habit. This caterpillar pupates in June and July in old stems of the previous year's growth, no more larvae occurring

till the next year. However, it may be that an earlier or later generation of the fly maintains itself on the excreta of the borers, upon decaying organic matter or upon other insects.

Gable (C. H.), Baker (W. A.) & Woodruff (L. C.). **The Sorghum Midge, with Suggestions for Control.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1566, 9 pp., 11 figs. Washington, D.C., September 1928.

Losses estimated at millions of dollars annually are sustained in the United States owing to the damage done to *Sorghum* by *Contarinia sorghicola*, Coq., which is well established in all the principal sorghum-producing sections of the United States, particularly in the Gulf States. No variety of *Sorghum* as yet known is resistant to the midge, which also infests various grasses. The adults appear in early spring when Johnson grass and other wild food-plants begin to bloom, and throughout the summer they oviposit on the flower-heads of any available food-plant. Each female deposits some 100 eggs on the inner wall of the glume ; only one is laid at a time, but several females may oviposit in succession in the same spikelet. The eggs hatch in two days, and the larvae extract their food from the developing grain, one larva being sufficient to cause the complete loss of the grain in a spikelet. The larvae mature and pupate in from 7 to 11 days, and after 3 more days the pupa works its way to the tip of the spikelet, and the adult emerges. Mating and oviposition occur almost at once, the adult living only 2 days. The average life-cycle occupies 14 to 16 days, and the cycles overlap to such an extent that all stages are found in the field together. One or two generations usually occur on self-sown or wild food-plants in early spring, before the cultivated crops bloom. Hibernation occurs as a larva within the puparium ; most of these larvae pupate and emerge as adults in the following spring, but many of them delay emergence until the second or third spring.

Birds, spiders and insects (especially the ants, *Iridomyrmex humilis*, Mayr, and *Solenopsis* spp.) are predacious on the pupae and newly emerged adults, and there are three small Hymenopterous parasites that increase rather slowly in the spring and do not affect the amount of damage done until late in the summer. Serious injury by the midges only occurs when there is some neighbouring source from which an influx of females may come. Johnson grass when allowed to head provides excellent hibernation quarters and blooms very early, and in this and *Triodia flava* the midge can breed throughout the summer. Infested *Sorghum* fields are also a constant source of invasion of healthy ones, migration occurring for a considerable distance, always in the direction of the prevailing winds. As all stages of the insect, except the adult, are passed within the husk, insecticides are ineffective. *Sorghum* should therefore be planted as far as possible from all outside sources of infestation and so that the prevailing wind blows towards them. Fields should be planted to bloom either before or at about the same date as fields from which infestation is expected, or after emergence has ceased in them. Any neighbouring heads, such as self-sown *Sorghum* or wild food-plants, should be destroyed before development of the grain. To reduce the possible number of generations of *C. sorghicola*, only one variety of the food-plant should be planted in a field, and farm measures should be practised to produce a sturdy, uniformly developed crop, eliminating Johnson grass so far

as possible from the vicinity. Burning over fields of Johnson grass and waste places during the winter will destroy many of the larvae in hibernation, and after harvest all loose heads should be raked up and destroyed. Small crops of seed can be obtained by tying paper bags over the heads of selected plants during the blooming season.

ROARK (R. C.). **Chemically combating Clothes Moths.**—*Soap*, iii, no. 12, pp. 95–101. New York, N.Y., August 1928.

This is a review of the developments in chemical methods patented in the United States during 1926–1928 for the purpose of combating clothes moths and other insects that attack woollens, mohair and other animal fibres. They include moth-proofing compositions, fumigants and repellents.

COTTON (R. T.) & ROARK (R. C.). **Ethylene Oxide as a Fumigant.**—*Indust. Engng. Chem.*, xx, no. 8, p. 805, reprint 3 pp. Easton, Pa., August 1928.

During an investigation to determine the value of certain aliphatic compounds as fumigants, it was found that the vapours of ethylene oxide (C_2H_4O) are highly toxic to insects. The properties of this gas are described. The concentrated vapours are inflammable, but concentrations lethal to insects can be used with safety. It is not highly toxic to man.

Tests carried out in a fumigation vault of 500 cu. ft. capacity showed that a dosage of 1 lb. to 1,000 cu. ft. for 20 hours was lethal to *Tineola biselliella*, Hum., *Attagenus piceus*, Ol., *Anthrenus vorax*, Csy., *Calandra* (*Sitophilus*) *oryzae*, L., *Plodia interpunctella*, Hb., *Silvanus* (*Oryzaephilus*) *surinamensis*, L., *Necrobia rufipes*, DeG., and *Tribolium confusum*, Duv., but for commercial fumigation 2 lb. to 1,000 cu. ft. is recommended. Comparative tests showed that ethylene oxide is slightly more toxic to pests of stored products than carbon bisulphide and about 30 times more toxic than carbon tetrachloride. Owing to its low boiling point, it is effective at comparatively low temperatures, the experiments being carried out at 60–70° F. Its powers of penetration are excellent, and insects buried in overstuffed furniture, in sealed packets of cereals or in jars of rice were killed with ease. No deleterious effect was noticed when clothing, furniture, metals, etc., were fumigated for 24 hours with a dosage of 2 lb. to 1,000 cu. ft. Foodstuffs such as dried fruit were unaffected, and no foreign taste or odour was discernible immediately after fumigation. No liquid foods were treated. The gas does, however, seriously affect the germinating powers of wheat. Preliminary tests indicate that it can be successfully used for vacuum fumigation.

CARTER (R. H.) **Solubilities of some Inorganic Fluorides in Water at 25° C.**—*Indust. Engng. Chem.*, xx, no. 11, p. 1195, reprint 3 pp. Easton, Pa., November 1928.

To be effective, insecticides must be sufficiently soluble to be toxic to the insect and at the same time must not be soluble enough to cause injury to plant foliage or to be too quickly washed off by rain or dew. The solubilities of various inorganic fluorides as determined

by other authors are given in a table, and since the results show considerable variation, experiments were carried out to test their solubilities at one temperature, namely 25° C. [77° F.] (which was chosen as representing approximately the average temperature of field conditions) in order to have a basis for comparison. The results are tabulated to show the solubility and fluorine content of each fluoride in gms. per 100 cc., and the pH of the saturated solution. The materials, apparatus and procedure are very briefly discussed.

Frost (S. W.). **A Study of the Genus *Eulia* Hübner with special Reference to the North American Species.**—*Bull. Pennsylvania Agric. Expt. Sta.*, no. 225, 24 pp., 4 pls., 1 map, 8 pp. refs. State College, Pa., May 1928.

The distribution of the moths of the genus *Eulia* is given, and the food-plants of the 14 North American species are listed. The method of oviposition and the general characters of the larvae, pupae and adults of this genus are discussed. Notes are also given on the bionomics and distribution of the more important North American species, with an annotated bibliography of the principal references to them.

Poos (F. W.). **An annotated List of some Parasitic Insects.**—*Proc. Ent. Soc. Wash.*, xxx, no. 8, pp. 145–150. Washington, D.C., 9th November 1928.

A list of sixty-three species of parasitic insects and their hosts, reared in eastern Virginia in 1926 and 1927, is given, with notes on some of them. In some instances the records show new distribution and new host associations for the parasites; no attempt to make the lists complete was made except in the case of *Phthorimaea operculella*, Zell. (potato tuber moth), 14 parasites of which are recorded. The parasites of *P. glochinella*, Zell., were of great benefit in keeping this moth in check on egg-plant and horse nettle [*Solanum melongena* and *S. carolinense*]. They included *Microbracon gelechiae*, Ashm., which was also the most abundant parasite of *P. operculella* during the early part of the year. Observations were made on its biology, the individuals observed being reared from the larvae of *Diatraea zeacolella*, Dyar. Unfertilised females produced only males. As many as 20 individuals were reared from one larva. The period from oviposition to the emergence of the adults ranged from 10 to 12 days, the pupal stage lasting 3–7 days. The average length of life of males under favourable conditions when kept in small vials was 6·6 days and of females 16·8 days.

Yearbook of Agriculture 1927.—8vo, xxii + 1234 pp., 293 figs. Washington, D.C., U.S. Dept. Agric., 1928.

The Yearbook for 1928 follows the same lines as that published in 1927 [*R.A.E.*, A, xv, 632]. A general account of various aspects of entomological research is given in the report of the Secretary of Agriculture. The following papers are of entomological interest: Moth-proofing Fluids sometimes of Value when properly used, by E. A. Back and R. T. Cotton, which emphasises the necessity of drenching fabrics thoroughly in solutions used for protection against clothes moths, and

discusses a number of solutions, the best results being given by one containing 0·29 per cent. fluosilic acid, 0·54 per cent. sodium fluosilicate and 0·5 per cent. calcium fluoride to 98·67 per cent. water; Cotton Pest [*Anthonomus grandis thurberiae*, Pierce] related to Boll Weevil now Quarantined in the West, by G. G. Becker; Gipsy Moth [*Porthetria dispar*, L.] Territory cut by Control Work—Quarantines Vital, by A. F. Burgess, which deals largely with the work in the barrier zone; Floods disturb Balance of Nature in the World of Insects, by B. R. Coad, in which the effect of the Mississippi floods on insects attacking cotton, maize, etc., is discussed; Mexican Bean Beetle [*Epilachna corrupta*, Muls.] spreading rapidly in the Eastern States, by N. F. Howard [*cf.* xvi, 398]; Japanese Beetle [*Popillia japonica*, Newm.] now faces Attack by five imported Parasites, by J. L. Knig [*cf.* xv, 443]; Insecticide Studies develop many new Methods to kill Pests, by C. H. Richardson; Japanese Beetle in ten Years invaded 13,919 Square Miles, by L. B. Smith, in which the general situation with respect to *P. japonica* is reviewed; Corn Borer [*Pyrausta nubilalis*, Hb.] makes Changes necessary in Farm Methods, by J. W. Tapp [*cf.* xvi, 452]; and Corn Borer Control Effort in $10,000,000 Program checks Pest, by W. R. Walton [*cf.* xvi, 391].

PETERSON (A.) & HAEUSSLER (G. J.). **Determination of the Spring-brood Emergence of Oriental Peach Moths and Codling Moths by various Methods.**—*J. Agric. Res.*, xxxvii, no. 7, pp. 399–417, 9 figs. Washington, D.C., 1st October 1928.

In this paper only the more striking results obtained from several methods of determining the spring-brood emergence of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) and *C.* (*Carpocapsa*) *pomonella*, L. (codling moth) in New Jersey are discussed. The object has been to develop a method that would give results corresponding to actual emergence in the orchard. Five types of wire-screen cages are described.

The following is taken from the authors' conclusions. It has been repeatedly observed that the overwintering larvae of *C. molesta* and *C. pomonella* that occur on the south side of tree trunks and usually near the ground are the first to pupate and become adult in the spring, whereas moths that emerge late come from cocoons in the most shaded parts of a tree or orchard. There is a marked difference in the temperature on the south and north sides of a fruit tree on clear days in spring, but little or no difference on cloudy days. The presence or absence of moisture about overwintering larvae seems to have a comparatively small effect on the emergence period of the moths. A higher mortality, however, occurs among larvae in cocoons in corrugated paper when this material is kept in a dry insectary than when it is frequently wetted.

Of the methods tested, the most satisfactory proved to be that involving the use of eight screen cages placed on poles or tree trunks, so that four were adjacent to the ground and four were 5 ft. above it, and one of each group of four faced north, east, south and west. This method permits an equal distribution of larvae in all situations that, so far as is known, are similar to those in nature; it is assumed that overwintering cocoons of both species are more or less equally distributed on all sides of the large branches and trunks of fruit trees, and also to some extent on the ground. The dates of the beginning and

peak of emergence for these moths in screen cages compare very favourably, for two or three seasons, with similar dates in the orchard ; whereas, for individuals overwintered in vials in a canvas band placed around a tree trunk about 2 ft. from the ground, in covered boxes, in a screened insectary and in a closed packing house, these dates are later than the normal ones in an orchard.

GENTNER (L. G.). **The Systematic Status of the Mint Flea Beetle (Chrysom., Coleop.), with Additional Notes.**—*Canad. Ent.*, lx, no. 11, pp. 264–266, 6 refs. Orillia, Ont., November 1928.

The synonomy of the beetle previously recorded as *Longitarsus menthaphagus*, Gentner [*R.A.E.*, A, xiv, 428] is discussed, and it is now shown to be identical with *L. waterhousei*, Kutschera. This beetle is recorded as being a serious pest of mint in England, and the author expresses the opinion that it was originally introduced into Canada from England on mint roots, some of which were brought into the country about 1870.

HUARD (V. A.). **Manuel théorique et pratique d'entomologie.**—Med. 8vo, ix + 164 pp., 49 figs. Quebec, 1927.

This is an elementary treatise on entomology designed for students in Quebec. It is divided into two parts, the first dealing with the anatomy and physiology of insects and including a chapter on their economic importance, and the second with their classification. Details are given for making and arranging a collection, and keys to all the families of insects occurring in North America are given.

[**Reports on the Insects of the Years 1926 and 1927.**]—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 7–25, 4 figs. Toronto, 1928.

Brief notes are given on insect pests in Ontario in 1926 and 1927 by W. A. Ross & L. Caesar, those in two districts of the Province in 1927 by C. B. Hutchings and H. F. Hudson respectively, and those in Nova Scotia in 1927 by J. B. Spittall.

GLENDENNING (R.). **Some Observations on Nicotine Dust.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 25–27. Toronto, 1928.

The results of applications of nicotine dust depend on the percentage of nicotine in the dust, the condition of the atmosphere, and the length of the exposure of the insect to the fumes ; and experiments were carried out with hydrated lime as a carrier for the nicotine, to determine the effect of these factors.

The strength necessary to kill varied with the insect ; for *Phyllotreta albionica*, Lec. (cabbage flea-beetle) a dust containing 3 per cent. actual nicotine was required to obtain a 90 per cent. kill, though *Phorodon humuli*, Schr. (hop aphis) was readily destroyed with a 1 per cent. dust. A 4 per cent. dust killed almost all the flea-beetles, but was inclined to be too damp and to cake, and was not distributed readily from a hand duster. It would therefore appear that with hydrated lime as a carrier, a 3 per cent. dust is as high a percentage as is practical and economical. The mortality among flea-beetles with

varying strengths of nicotine dust ran in a fairly regular progression, the average percentages killed being 44 for 1 per cent. dust, 68 for 2 per cent. and 91 for 3 per cent.

Length of exposure to the fumes appears to be the most important factor in the control of Aphids. In dusting for *P. humuli*, slight air movements could be largely overcome by extra heavy applications, but this very greatly increases the cost. In the case of *Phyllotreta albionica*, the air movement seemed to be of less importance, flea-beetles being apparently peculiarly susceptible to nicotine fumes. It was found that exposure for 15 seconds at least is necessary to kill *Phorodon humuli*, while *Phyllotreta albionica* and the hop flea-beetle [*Psylliodes punctulata*, Mels.] are killed after an exposure of 3 seconds, the different results being probably due to the varying rates of respiration; flea-beetles lose all power of movement after 15 seconds, while the hop aphis often remains alive from 12 to 24 hours after dusting. Variations in temperature are only of importance when hand operated machines or power machines without agitators are used; with these machines a minimum shade temperature of 70° F. was necessary for an effective kill, but otherwise, owing probably to the fact that the agitators raise the temperature of the dust to about 130° F., a hundred per cent. mortality of *P. humuli* was obtained at an air temperature of 50° F. During the course of these experiments dusting was found to be as effective on dry as on damp days, taking the temperature into consideration; the addition of 6 per cent. moisture to the dusts did not produce a markedly different result.

Though dusts can be applied at a rather lower cost than sprays, it is unlikely that dusting will supplant spraying in British Columbia, owing to the limited period during which the atmospheric conditions are favourable. Nicotine dust will, however, continue to be used on hops, especially if outbreaks of red spider [*Tetranychus telarius*, L.] occur, as a combination dust of ground sulphur, hydrated lime and nicotine sulphate has been found most effective in destroying both mites and Aphids at one operation. It has also proved to provide the only satisfactory method of controlling *P. albionica*.

GILLIATT (F. C.). **A Preliminary Report on some of the Bud-moths and Leaf Rollers of Nova Scotia.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 27–39, 1 chart. Toronto, 1928.

This is a preliminary account of detailed studies begun in 1926 on bud-moths and leaf-rollers attacking apple trees in Nova Scotia. A chart indicates the comparative length of the various stages of some of these moths, the periods representing the average for two seasons. Details of the bionomics of *Eucosma* (*Spilonota*) *ocellana*, Schiff., *Tortrix* (*Cacoecia*) *rosaceana*, Harr., and *Argyroploce variegana*, Hb., which pass the winter as partly grown larvae in hibernacula on the trees and have only one generation a year, are given.

The feeding habits of the minor pests, *Tortrix* (*Pandemis*) *limitata*, Rob., *T.* (*Cacoecia*) *persicana*, Fitch, and *Eulia mariana*, Fern., which appear to be typical leaf-rollers, are discussed in detail. *T. limitata* hibernates in the larval stage on the tree, emerges towards the middle of May, and eats its way into the opening buds; pupation takes place during the latter part of June in leaves rolled by the larvae, and the adults emerge in 11 to 16 days. The eggs are laid 3–5 days after

emergence, on the upper surface of the leaves. The first larvae hatch about 25th July and are distributed to all parts of the tree by dropping on to the leaves. The larvae use the leaves that have been webbed together by *E. ocellana* as a protection during the period directly preceding hibernation (towards the middle of August), and it would appear that *T. limitata* is so dependent on *E. ocellana* in this respect that it is unlikely to become a serious pest except in orchards previously infested by the latter. When bunches of foliage are in contact with the fruit, the larvae feed on the surface and make scars that constitute the worst form of injury caused by this moth.

T. persicana, Fitch, hibernates in the larval stage in fallen leaves on the ground. The larvae ascend the trees at the beginning of May, eating the first green buds with which they come into contact. In early June they descend and pupate in the loose rough bark or in rolled leaves on the ground. The adults emerge in 2 weeks and oviposit after about 4 days on the upper surface of the leaves and probably also on the smooth bark of the larger limbs. The eggs hatch in 12–15 days. The injury caused by this pest is similar to that done by *T. limitata*; it is thought that there is little likelihood of *T. persicana* becoming a serious pest if clean cultivation is practised, but that it is likely to increase where the sod or semi-mulch system is in use.

Eulia mariana, Fern., hibernates in the pupal stage in fallen leaves on the ground. The adults emerge during the latter part of May or in the first week in June; eggs are laid after 3 days in masses of from 50 to 140, in the same positions as those of *T. persicana*, and hatch in about 20 days. The larval stage lasts about 75 days. *E. mariana* causes considerable injury to the fruit, sometimes scarring a third to half of the surface when the fruit is so near maturity that no protective covering is formed, and early decay frequently results. Owing to the late appearance of the larvae on the foliage and the method of feeding, arsenical sprays are not effective; clean cultivation is at present the best known remedy.

A single record of *E. quadrifasciana*, Fern., was made from apple in one locality.

Hemerophila (*Allononyma*) *vicarialis*, Zell., skeletonised the foliage of entire orchards in one district. There are two generations a year, adults of the first appearing in July and those of the second in late September and October; pupation takes place on the lower surface of the leaves. The contrast in the rate of infestation in sprayed and unsprayed orchards indicates that this pest is controlled by the regular spring spraying. *Tortrix afflictana*, Wlk., also attacks apple foliage and was found feeding on the fruit in one instance. There is probably only one generation a year. The larvae mature in the late autumn, hibernate in fallen leaves and pupate in early spring; the adults emerge in early June. *Amorbia humerosana*, Clem., also appears to be a typical leaf-roller and was recorded as feeding on apple foliage in one locality. The larvae collected pupated in October, and the adults emerged in the following June.

McLaine (L. S.). **The Mexican Bean Beetle in Ontario.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 39–41. Toronto, 1928.

The history of the distribution of *Epilachna corrupta*, Muls. (Mexican bean beetle) in the United States and in Canada is discussed. The beetle was first recorded in Canada in July 1927, and investigations

continued until late August resulted in the discovery of several infestations in south-western Ontario. The intensity of infestation varied greatly, but in all the fields attacked several infested patches could be found distributed throughout the field, from 2 to 50 plants being attacked in each spot.

It is impossible to predict the extent of injury that may be caused by *E. corrupta* in Ontario, where beans are a very important crop.

Hudson (H. F.) & Wood (A. A.). **Some Notes on the Life-history of the Mexican Bean Beetle in Ontario.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 41–42. Toronto, 1928.

Pupae of *Epilachna corrupta*, Muls. (Mexican bean beetle) were collected in the field in Ontario on 4th August 1927. Adults emerged in the laboratory on 9th August and oviposited next day, the eggs being laid on the lower surface of the bean leaves in clusters containing an average of 45. One female laid 656 eggs. The eggs hatched in 7–14 days, and the larval and pupal stages averaged 30 and 12·5 days. There are probably two generations a year, hibernation taking place in the adult stage. The feeding habits of the adults and larvae are discussed.

Curran (C. H.). **Latest Developments in the Control of Stored Product Pests with Calcium Cyanide.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 42–43. Toronto, 1928.

The bulk of the information given in this paper has been previously noticed [*R.A.E.*, A, xvi, 281]. All rugs, curtains, etc., should be removed from buildings to be fumigated with calcium cyanide, since hydrocyanic gas has a tendency to bleach materials coloured with certain dyes. It has been found that Coleoptera are more resistant to fumigation than Lepidoptera, a dosage of 2 lb. to 1,000 cu. ft. being needed to kill all stages of the former, while 1½ lb. is sufficient for the latter.

Caesar (L.). **The Corn Borer Act in Operation.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 51–54. Toronto, 1928.

An account is given of the difficulties encountered in enforcing the Corn Borer Act, which provides for ploughing and destruction of stubble, etc., in maize fields against *Pyrausta nubilalis*, Hb., and of the results obtained from one year's operation. Eight counties were put under the Act in the autumn of 1926, seven of which were the worst infested in Ontario. The main work of enforcing the Act took place during the spring, and the fact that there had been an excessively wet autumn in 1926 made it impossible in most cases to do any autumn ploughing, so that the farmers were very busy in the spring ; numerous other difficulties are mentioned, but in spite of these the results were better than had been anticipated. In five counties there was an average decrease in infestation of 33 per cent. ; in the other three, however, there was an increase of about 29 per cent. This increase was probably due to a less thorough enforcement of the Act and to weather conditions. From rough estimates of the rate of infestation in the parts of the Province not under the Act, the author is convinced that there has been an

increase of at least 100 per cent. In view of this, the Act has now been made operative over a larger area than had been previously thought necessary.

JONES (D. W.). **Parasites of the European Corn Borer.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 55–56. Toronto, 1928.

Short notes are given on the following parasites of the European corn borer [*Pyrausta nubilalis*, Hb.], which are believed to be firmly established in Massachusetts: *Masicera senilis*, Rond., *Phaeogenes planifrons*, Wesm., *Eulimneria crassifemur*, Thom., *Dioctes punctoria*, Roman, *Microgaster tibialis*, Nees, and *Pimpla* (*Exeristes*) *roborator*, F. *P. planifrons* attacks the pupae, the others being parasites of the larvae. The following six species have been liberated, but for too short a period for any results to be estimated: *Zenillia roseanae*, B. & B., *Microbracon brevicornis*, Wesm., *Apanteles thompsoni*, Lyle, *Macrocentrus abdominalis*, F., and two species of *Campoplex*.

KEENAN (W. N.). **The Spread and Degree of Infestation of the European Corn Borer in Canada, 1927.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 56–59. Toronto, 1928.

As a result of special investigations, reductions in the degree of infestation by the European corn borer [*Pyrausta nubilalis*, Hb.] have been noted in several of the areas in south-western Ontario where compulsory control has been enforced. Of 62 collections of the borer made in Ontario and Quebec, 59 were from districts not previously found infested. The whole extent of corn-borer infestation is 575 miles from east to west in Ontario and Quebec and 385 miles from north to south in Ontario. A table is given showing a summary of the corn borer infestation records of 1927 compared with those of 1926.

DOWNES (W.). **On the Occurrence of *Aphodius pardalis*, Lec., as a Pest of Lawns in British Columbia.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 59–61. Toronto, 1928.

A case is recorded of severe injury to a bowling green by the larvae of *Aphodius pardalis*, Lec.; the sod was cut off evenly about three-quarters of an inch below the surface, and large patches turned brown and died. In October 1926 adult females were numerous 2–2½ ins. below the surface of the soil; no eggs were found at that time, but larvae appeared in soil taken from this area and kept in a soil box out of doors. In May 1927, larvae of various ages were found in the field, the majority of which were nearly full-grown. Far fewer larvae were present, and no stripping of the turf occurred.

A. pardalis is a very common species on the Pacific coast, but no previous case of injury to lawns has been recorded; the present instance is probably accounted for by the fact that the bowling green and a golf course are practically the only possible breeding grounds for *A. pardalis* in the neighbourhood, and the soil to make these was brought from a hillside nearby. The period of infestation had been exceptionally dry, and as the larvae need moisture, the beetles would tend to concentrate where turf is watered regularly.

Experiments were made with carbon bisulphide-soap emulsion and a proprietory fumigant, but no satisfactory method of control has yet been obtained.

Baker (A. D.). **The Habits of Onion Maggot Flies** (*Hylemyia antiqua*, **Meigen**).—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 61–67, 3 figs. Toronto, 1928.

This is a summary of observations on the feeding habits of the adults of *Hylemyia antiqua*, Mg. (onion maggot). The flies only feed to a very slight extent on the onion plant, living largely on drops of water, etc., adhering to the foliage. In captivity they could be kept alive for a considerable time and oviposited readily when sugar or molasses solution was introduced into the cages, but died within a short period if they were only fed on water-saturated manure or on healthy potted onion plants, even when the soil around these was kept moist. In the field, flies feed on flowering plants; those with small flowers are most frequently visited, and the most sought after is the common dandelion (*Taraxacum officinale*). The importance of the control of this plant is emphasised. There are two full but overlapping generations of *H. antiqua* a year and at least a partial third; by far the greatest damage is done by the first. Dates of emergence depend to a great extent on weather conditions, but the occurrence of the first and second generations of the flies is largely coincident with the flowering of the dandelion, and control measures, which are for the most part directed against the eggs and adults, should begin when the flowers appear in the spring. Flies are active in the field 10–14 days before oviposition takes place.

The resting-places of the flies in wet weather are discussed; they do not seek shelter, as water is not injurious to them so long as it is free to run off their bodies. Oil is, however, absorbed by the body of the fly, cedar oil being particularly toxic, and also tending to act as a repellent. Cedar oil cannot be used as a remedial measure, as it kills the onion plants, but good results have been claimed from the use of a Bordeaux oil emulsion.

Since infestation by *H. antiqua* was found to be sporadic, investigations were made into the suitability of various soils for oviposition, but the results indicated that the predominance in any one factor or group of factors, such as would occur in fields suitable for the growth of onions, would not be important in rendering a field more susceptible to infestation. No samples from uninfested soil had a percentage of combustible matter as low as the average for infested soils, and no infested soil had a percentage as high as the average for uninfested soils. Further tests, however, led to the belief that the varying rates of infestation found in fields with high and low percentages of combustible matter in the upper layers of soil are due, not so much to any principle attractive to the ovipositing flies, as to conditions being more suitable for the development of natural enemies, particularly the Staphylinid, *Baryodma ontarionis*, Csy.

H. antiqua cannot be successfully reared on manure, and the presence of the flies in the vicinity of manure heaps, which is most noticeable on cool spring days, is probably due to a thermotropic rather than a chemotropic response.

Twinn (C. R.). **The Canadian Insect Pest Survey.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 67–69. Toronto, 1928.

A short account is given of the Canadian Insect Pest Survey service started in 1922. It is hoped that, by correlating the data accumulated

by the survey with a study of the conditions governing insect abundance, to forecast outbreaks of certain species with some degree of accuracy. The results of the survey are compiled under two headings, the Insect Pest Record, which is a card index system, and the Insect Pest Review, which has been issued monthly from April to October since 1923.

KELSALL (A.) & SPITTALL (J. P.). **Effect of Calcium Arsenate on Forest Trees.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 69–70. Toronto, 1928.

Since calcium arsenate is cheaper and more easily obtained in some districts than lead arsenate, which has generally been used with safety, tests have been made of its effect on forest trees. A standard commercial material, which has been used satisfactorily on potatoes and in orchards, was used in these experiments, in one series as a spray at the rate of 1 lb. to 40 gals. water and in the second as an undiluted dust. Each variety of tree was treated twice with both of these materials, on 16th June and 4th July. The only tree that suffered any injury at the first application of either material was white birch, the foliage of which was severely scorched by the dust. The weather following this application was unusually dry ; after the second application, however, until the trees were inspected on 27th July, rain fell on 13 days. The second application resulted in injury to nine species of trees from the spray and eleven from the dust, white spruce [*Picea glauca*], pine and larch being the only trees entirely uninjured. These results indicate that under dry conditions the trees are tolerant to the arsenical and that young leaves are more resistant than the later growth; it is also thought that the foliage was capable of tolerating one application but not a second. It is concluded that calcium arsenate may be safely used on soft-wood trees, but that there are elements of danger in its use on hard-wood trees, at least in moist climates.

GORHAM (R. P.). **The European Rose Sawfly in New Brunswick.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 70–72. Toronto, 1928.

Emphytus (*Allantus*) *cinctus*, L. (rose sawfly) has caused considerable injury to rose foliage in one greenhouse in New Brunswick for several years. It is thought that the sawfly was introduced in the egg stage on imported rose plants ; larvae of this species have since been reared from eggs taken from imported roses. *E. cinctus* has not been found on roses grown in the open in New Brunswick. There are two generations a year in the greenhouse. The adults begin to emerge early in March and oviposit immediately ; emergence continues at intervals until the beginning of May, all stages being present during the latter part of April. The autumn generation larvae occur from September to December. The eggs are laid in the upper epidermis of the leaf, and the larvae, which hatch in 8–12 days, cut through the lower surface, on which they feed. After about three weeks, the full-grown larva burrows in the pith of the rose branch, forming a small chamber closed at both ends with thin partitions of pith fragments ; two or more larvae sometimes enter the same branch. Several months are passed in the chamber, pupation taking place about 2 weeks before the emergence of the adults.

The rose bushes in one greenhouse were pruned in early spring, and large numbers of sawflies emerged from the prunings, which had been taken into the laboratory. The infestation in the greenhouse was so far reduced as a result of this that no further control measures were needed that season. Measures recommended are the pruning and burning of the dried twigs in which the larvae pupate, the destruction of leaves on which eggs are found, and dusting with derris against the larvae. It has also been found that adults and larvae are killed by hydrocyanic acid gas fumigations, as usually employed in greenhouses.

THOMPSON (R. W.). **The Golden-glow Borer** (*Epiblema carolinana*, **Walsingham**).—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 73–75, 3 figs. Toronto, 1928.

An account is given of observations on the bionomics of *Epiblema carolinana*, Wals. (golden-glow borer), which is commonly mistaken for the European corn borer [*Pyrausta nubilalis*, Hb.], carried out in Lambton County, Ontario, in 1927. The larvae were only found on golden-glow [*Rudbeckia*], feeding in the flowers and boring in the stems and roots. Pupation occurs in late spring or early summer, the moths emerging in July and August. All stages are described, and the characters distinguishing the larvae from those of *P. nubilalis* are indicated.

SEAMANS (H. L.). **Forecasting Outbreaks of the Army Cutworm** (*Chorizagrotis auxiliaris*, **Grote**).—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 76–85, 4 figs., 4 refs. Toronto, 1928.

Chorizagrotis auxiliaris, Grote (army cutworm) is an occasional pest on the plains adjacent to the Rocky Mountains, outbreaks occurring so suddenly in certain years that no adequate preparation of control measures can be made. Efforts have been made to ascertain the reason for the sudden increases in the numbers of this pest, and it has been found that parasites and disease were sufficient to cause fluctuation only in isolated cases.

The eggs of *C. auxiliaris* are laid in soft uncaked soil, irrespective of whether there is any vegetation present, some time after the third week of August; in some seasons oviposition continues well into October. At a temperature of 55° F., hatching occurs in 10 to 14 days, but may not occur for six weeks or two months if the eggs are kept very dry, when only a few hatch and the larvae are small and weak. Soil moisture in considerable quantities is essential for first instar larvae, irrespective of the moisture content of their food, 96 per cent. dying in the laboratory when kept at a humidity of 60 per cent. with fresh succulent dandelion as food. Freezing stops all development until there has been a rise of temperature to 60° F., when it is resumed, while feeding stops at about 45° F., and the larvae become inactive at the coming of prolonged cold weather. There is apparently no real hibernation, the winter being spent in the loose soil at the surface of the ground, where the larvae are to some extent subject to changes of temperature; and activity is sometimes resumed during the winter when the weather has become warm. Pupation takes place in an earthen cell 2 to 3 ins.

below the surface of the soil. In an average year the majority of the larvae have pupated by 20th May, and the adults usually begin to emerge after the first week of June. The presence of *C. auxiliaris* in the neighbourhood of houses is probably accounted for by the fact that the moths are looking for places in which to hide rather than that they are attracted to light. The moths aestivate in warm weather, large numbers hiding under clods and weeds in the field. When the weather cools, usually towards the end of August, activity is resumed and the females are ready to oviposit.

From a study of records in widely scattered localities in Alberta, Montana and Colorado, it is evident that outbreaks are directly concerned with a weather condition that is so far from normal that it cannot be a common occurrence. In the western Great Plains area, it has been found possible to forecast with considerable accuracy any likelihood of an increase in the numbers of *C. auxiliaris* by recording the rainfall and temperature from 1st July to 1st November. A July with less than 1½ ins. rainfall and a mean temperature above 63° F. is favourable to increase, but does not necessitate an outbreak in the following year; if, however, the dry July is followed by a total of over 4½ ins. rain during August, September and October, with the greater proportion of this coming in September, an outbreak is assured. Climographs are given showing cutworm years in various localities between 1924 and 1926.

[**Insect Pests in Mexico, May-September 1928.**]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. México,* ii, nos. 6–7, 8–9, pp. 323–361, 488–583. S. Jacinto, D.F., 1928.

The insects mentioned in this report include *Schistocerca paranensis*, F., which increased in some districts; *Platyedra* (*Pectinophora*) *gossypiella*, Saund., *Anthonomus grandis*, Boh., and other pests of cotton, which caused losses in the Lagunera cotton districts that are estimated to amount to over £1,000,000 in 1928; *Macrodactylus* sp., which attacked maize, hand collection and spraying with calcium arsenate being the measures advocated; the fruit-flies, *Anastrepha fraterculus*, Wied., *A. ludens*, Lw., and *A. striata*, Schin.; and *Epilachna corrupta*, Muls., and other species of the genus, which were widespread pests of beans.

D[AMPF] (A.). **Experimento sobre el uso del carbonato de cobre para proteger al maiz.** [An Experiment on the Use of Copper Carbonate to protect Maize.]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. México,* ii, no. 8–9, pp. 437–440, 1 fig. S. Jacinto, D.F., 1928.

To test the value of copper carbonate against weevils and other pests of stored maize, three sealed boxes were placed in line near each other, the centre one communicating with each of the others by a tube. Maize severely infested with *Calandra* was put in the centre box, while uninfested maize was placed in the others, the maize in one of them being mixed with copper carbonate dust. The boxes were examined after about a year. In the untreated maize, 1,583 live weevils were found, and 398 dead and 34 live individuals in the maize mixed with copper carbonate. The difference may be due to a repellent action of the chemical or to reproduction in the untreated maize.

D[AMPF] (A.). **Las semillas brincadoras de Mexico.** [Mexican Jumping Beans.]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. México*, ii, no. 8–9, pp. 440–451, 2 pls., 40 refs. S. Jacinto, D.F., 1928.

The Cuban quarantine against "Mexican jumping beans" is unjustified, as the "beans" are really the seeds of *Sebastiania pavoniniana*, and the caterpillar within them, *Cydia* (*Grapholitha*) *saltitans*, Westw., is a monophagous species that may perhaps attack other Euphorbiaceae, but only if growing in arid situations.

CUNNINGHAM (H. S.). **The Palmetto Scale.**—*Agric. Bull. Bermuda Dept. Agric.*, vii, no. 12, pp. 6–7. Bermuda, December 1928.

The distribution in Bermuda of *Comstockiella sabalis*, Comst., which attacks the native palmetto (*Sabal blackburnianum*), is discussed. Badly infested trees are seriously injured or even killed. Although the scale may be kept in check by spraying, it is necessary to direct the force of the spray downwards in order to reach the axils of the leaves and the younger leaves at the growing point, and the height and inaccessibility of many of the infested palms renders this extremely difficult. Many of the Coccids are so protected by the fibrous sheath of the palm that they escape injury from the insecticide, even when spraying is thoroughly carried out.

BRUNER (S. C.). **Notas sobre ciertos enemigos de la caña de azucar.** [Notes on certain Pests of Sugar-cane.]—*Rev. Agric. Com. Trabajo*, x, no. 3, pp. 27–32, 9 figs. Havana, September 1928.

Brief notes are given on the following insects attacking sugar-cane in Cuba: The Acridid, *Schistocerca pallens*, Thunb.; the Eumolpid, *Myochrous dubius*, F.; the Rutelid, *Anomala calceata*, Chev.; a Scolytid, *Xyleborus* sp., possibly *X. perforans*, Woll.; the Hesperiid, *Perichares corydon*, F.; and the Noctuids, *Remigia punctularis*, Hb. (*repanda*, auct.), and *Laphygma frugiperda*, S. & A.

WOLCOTT (G. N.). **Los Afidos que afectan la Industria Azucarera del Perú.** [The Aphids affecting the Sugar Industry of Peru.]—*La Vida agric.*, v, no. 59, pp. 877–886, 1 fig. Lima, Peru, November 1928.

The best known Aphid in Peru is *Aphis gossypii*, Glov., which is a pest of cotton. Since the discovery of the mosaic disease of sugar-cane near Lima, the presence in abundance of *A. maidis*, Fitch, on such common grasses as *Panicum barbinode*, Johnson grass [*Sorghum*] and *Arundo donax*, may assume an even greater importance. The thoroughness with which fields of young plant or ratoon cane are cultivated in Peru forces this Aphid to leave its normal grass food-plants and increases the danger of its acting as the vector of sugar-cane mosaic, while the scarcity of fields of maize in the coastal regions, where the commercial cane crop is largely produced, minimises its importance on this plant. *A. maidis* has been found on grasses in cane fields in all parts of Peru, but the yellow Aphid of sugar-cane, *Sipha flava*, Forbes, has been observed only in certain northern valleys, on sugar-cane and lemon

grass. Presumably it will not become a serious pest so long as Uba cane is not widely grown in place of varieties that are susceptible to mosaic disease.

TOWNSEND (C. H. T.). **Insectos que atacan al Algodón y a la Caña de Azúcar en el Perú.** [Insects attacking Cotton and Sugar-cane in Peru.]—*Bol. Estac. exper. agric. Soc. nac. agrar.*, no. 1, 29 pp., 36 figs. Lima, May 1928.

The first part of this bulletin deals briefly with 51 pests of cotton observed in Peru, including several species already noticed [*R.A.E.*, A, xiv, 251, 545 ; xvi, 251]. The weevil, *Gasterocercodes gossypii*, Pierce, is one of the most serious pests of cotton in Peru. It oviposits in the bark at or below ground-level, and the larvae mine in the stems and roots, withering of the leaves being the first symptom of injury. The only means of control is to clear the fields of all old roots, etc., and also of *Hibiscus* and *Stylosanthes*, replant every year with an early variety of cotton, and irrigate with the least possible quantity of water. Other cotton pests include *Tetranychus peruvianus*, McGr.; a Pyrrhocorid, *Stenomacra* sp., the adults of which are parasitised by a Chalcid, *Sophencyrtus townsendi*, Crwfd., and by a fly, *Xanthomelanopsis peruana*, Towns. ; the larvae of the Dynastid, *Ligyrus maimon*, Erich., which is parasitised by a fly, *Rhamphinina discalis* ; the caterpillars of *Melipotis walkeri*, Butl., which are parasitised by a fly, *Reaumuria pacifica*, and may be controlled by means of an arsenical poison-bait ; *Heliothis* (*Chloridea*) *obsoleta*, F. ; *Anomis luridula*, Guen. (*texana*, Riley), which has many parasites, including the Tachinid, *Eucelatoria australis*, Towns. ; and *Mescinia peruella*, against which an arsenical insecticide may be used, as the young caterpillars feed outside the bolls before entering them.

Diatraea saccharalis, F., is the most serious pest of sugar-cane in Peru. Its egg-parasite, *Trichogramma minutum*, Riley, is abundant, other parasites being *Eremotylus flavofuscus*, Brullé, and *Ipobracon* spp., which, together with the Tachinid, *Paratheresia signifera*, Towns., attack the larvae. Other pests include *Trionymus* (*Pseudococcus*) *sacchari*, Ckll. ; a Scolytid, *Microborus* sp ; two weevils, *Eumycterus saccharidis*, Barber, and *Metamasius anceps*, Gyll. ; a Melolonthid, *Ancistrosoma* sp. [*R.A.E.*, A, xii, 558] ; the Dynastid, *Ligyrus maimon*; and *Aphis maidis*, Fitch.

[D'EMMEREZ DE CHARMOY (D.).] [**Insect Pests in Mauritius in 1927.**] —*Ann. Rep. Dept. Agric. Mauritius 1927*, pp. 3 & 12–13. Mauritius, 1928.

The pests recorded include : *Aspidiotus destructor*, Sign., on coconut; *Phthorimaea operculella*, Zell., on tobacco ; *Porpe bjerkandrella*, Thunb., on artichoke ; and *Cosmopolites sordidus*, Germ., on banana. A prickly pear Coccid [*Dactylopius tomentosus*, Lam.] has been introduced from Ceylon for the control of *Opuntia tuna*.

In the section dealing with pests and diseases of sugar-cane, a further centre of infestation of *Lachnosterna* (*Phytalus*) *smithi*, Arrow, is reported. The total area infested by this beetle is about 41,000 acres, but actual damage is experienced only over an area of about 2,500

acres, control measures, particularly the introduction of the parasite *Tiphia parallela*, Smith, being primarily responsible for this. The application of calcium cyanide to canes infested with *L. smithi* has given promising results.

DE LEPINEY (J.) & MIMEUR (J. M.). **L'*Earias insulana* et son parasite *Microbracon brevicornis*, au Maroc.**—*Agron. col.*, no. 131, pp. 133–137. Paris, November 1928.

The bionomics of *Earias insulana*, Boisd. (spiny bollworm) are discussed; they are very similar in the cool climate of Morocco and in tropical regions. The variations in the numbers of the bollworm in isolated patches of perennial cotton are accounted for by the amount of food available and not by variations in temperature, which may influence the length of the life-cycle, but have no effect on oviposition. Annual cotton is infested largely from the outside, since at the beginning of the season no bollworms can be observed, and by the time the plants are pulled up, large numbers are present. In order to keep *E. insulana* well under control in areas where perennial as well as annual cotton is grown, the rate of parasitism must be very high. A parasite found on *E. insulana* has been identified as *Microbracon brevicornis*, Wesm. (*Rhogas kitcheneri*, Dudg. & Gough) by Ferrière, who points out that it is not identical with *M. hebetor*, Say, which attacks *Ephestia kühniella*, Hb., and other Pyralids, and which has been frequently recorded under that name.

The eggs of *M. brevicornis* hatch in 1–3 days, and the larvae attach themselves to the host immediately on emergence, 13 having been observed on one individual. The pupal stage lasts 7 days or less, and the maximum length of the life of the female adult in captivity was 13 days. The total life-cycle in summer lasts from 14 to 17 days. Eggs are laid parthenogenetically, 24 hours after emergence; no fertilised eggs were found during the course of these investigations, males only being observed when larvae of *Earias* were not available. Punctures are made in the body of the host larva, which dies in 6 to 10 days. Eggs laid in larvae paralysed for more than 48 hours are unable to develop and die with the decomposing host. In the laboratory one female laid 70 eggs in 13 days, while individual hosts carried up to 42 eggs.

PIÉDALLU (A.) & BALACHOWSKY (A.). **Utilisation de la chloropicrine contre les cochenilles nuisibles aux orangers ou aux dattiers.**—*Bull. agric. Algérie-Tunisie-Maroc*, xxxiv, no. 10, pp. 181–183. Algiers, October 1928.

The authors have experimented with chloropicrin as a fumigant against Coccids affecting oranges and dates in Algeria. The liquid must evaporate fairly quickly (in 45–60 minutes), and the fumes, which are heavy and tend to descend, must saturate the cubic space in the tent evenly. It is therefore best to heat the air under the cover, not with coke, charcoal, etc., which cause scorching of the foliage, but with an oil or spirit lamp or by electricity. The results of various doses on several species of Coccids show that chloropicrin, thus employed, at the rate of 1–1½ oz. to 70 cu. ft. is fatal to them. To avoid injuring the plants, the fumigant should be applied after the crop is gathered and before the next blossoming.

Seydel (C.). **Instructions relatives à la récolte, la préparation, l'emballage et l'envoi des insectes nuisibles aux cultures.**—*Bull. agric. Congo belge*, xix, no. 2, pp. 333–336. Brussels, June 1928.

Instructions are given for the collection, preparation, labelling, packing and sending of injurious insects destined for a laboratory or museum, with notes on the preparation of samples of the damage caused, and on the rearing of unidentified larvae. A list of the necessary equipment is also given.

Jack (R. W.). **Trap Cropping against Maize Pests.**—*Rhodesia Agric. J.*, xxv, no. 11, pp. 1228–1231 ; also as *Bull.* [*Dept. Agric. S. Rhodesia*], no. 714, 4 pp. Salisbury, Rhodesia, November 1928.

In Rhodesia the trap-crop for *Busseola* (*Glottula*) *fusca*, Fuller (maize stalk borer), and weevils (*Systates* and *Tanymecus*) and other insects that attack the foliage of young maize consists of as many rows of early planted maize as can be dealt with at the right time, self-sown maize being also very attractive to the pests. In South Africa Mally, referring only to *B. fusca*, suggests four rows extending across the land about 300 yards apart. On smaller areas, however, the rows might be more conveniently placed round the edges of the land to facilitate their subsequent removal, but for weevils their regular distribution over the area would be best. November appears to be sufficiently early to plant the rows before the rains, it being frequently necessary to defer the planting of the main crop until December. Deep sowing will help to protect seeds in dry ground against insects. The trap-crop must be encouraged to produce vigorous growth, even by the use of a fertiliser where needed.

In order to avoid migration of the stalk borers to surrounding plants, it is absolutely necessary to uproot and immediately remove the trap-crop, together with self-sown maize, from the plantation to a distance of several hundred yards soon after the egg-laying period of the November–December brood, namely, by 15th December, or as early as the 10th if signs of migration or heavy infestation be observed. The young borers will not mature in the wilting plants. The February brood, which is usually a much larger one, prefers backward maize, and late plantings for silage commonly serve as an excellent trap for it, the borers being eventually killed in the silo.

If the trap-crop or self-sown maize is heavily attacked by weevils and other leaf-eating insects before the main crop is planted, by lightly spraying these plants, as well as weeds, with a mixture of 1 lb. sodium arsenite, 8 lb. sugar or 1–2 gals. molasses and 10 gals. water, a large percentage of the pests will be killed. Lead arsenate, which has not been thoroughly tested against weevils and is more expensive and slower in action, might be a better poison to use than sodium arsenite, since the latter, by seriously scorching the maize or killing it outright, renders the trap-crop valueless against *B. fusca*. But as considerable damage to the main crop by weevils is certain to follow a heavy infestation of the trap, unless the insects are destroyed, and as subsequent loss from the stalk borer is unlikely to be serious if December planting is practised, the trap-crop may well be sacrificed to deal with the beetles.

New South Wales: **Proclamation under the Plant Diseases Act, 1924.**—*Govt. Gaz.*, no. 128, reprint 1 p. Sydney, 14th September 1928.

All *Citrus* trees infested with *Chrysomphalus aurantii*, Mask., in New South Wales must be fumigated for at least 45 minutes with hydrocyanic acid gas sufficient to kill the scale, or be effectively sprayed with miscible oil.

New South Wales: **Proclamation under the Plant Diseases Act, 1924.**—*Govt. Gaz.*, no. 128, reprint 1 p. Sydney, 14th September 1928.

To prevent the introduction into New South Wales of the beetle borer [*Cosmopolites sordidus*, Germ.] and of bunchy-top, no plants of banana, plantain or manilla hemp, or any parts of them, may be introduced, unless they are free from roots and soil, all suckers are cut down to a length of 2 ft., and they are accompanied by a certificate of freedom from pest and disease.

New South Wales: **Proclamation under the Plant Diseases Act, 1924.**—*Govt. Gaz.*, no. 147, reprint 1 p. Sydney, 26th October 1928.

To prevent infestation by *Cydia pomonella*, L., all apple, pear and quince trees and suckers must be thoroughly sprayed four times every year at specified times with lead arsenate in the proportion of not less than 20 oz. powder to 50 gals. water. Dead bark and broken limbs must be removed from the trees, and all cavities kept free from larvae and pupae of the moth. All fallen fruit must be collected at least once every three days, and all infested fruit destroyed. The trunks of the trees and branches rising from the ground must be banded from the middle of November until June or July of the following year, all larvae and pupae being removed at intervals. The methods to be followed in banding are described.

Ramsay (A. A.). **Cyanides used for Fumigation.**—*Agric. Gaz. N.S.W.*, xxxix, pt. 10, pp. 783–786. Sydney, 1st October 1928.

The history of the discovery and manufacture of cyanide compounds is reviewed. The quality of sodium and potassium cyanides is discussed, and the author points out that if the higher grades were used for fumigation, the possible injury to plants due to the presence of impurities would be considerably reduced.

Tindale (N. B.). **Species of *Chlenias* attacking Pines (Lepidoptera, Family Boarmiidae).**—*Rec. S. Aust. Mus.*, iv, no. 1, pp. 43–48, 2 figs. Adelaide, 30th September 1928.

Chlenias pini, sp. n., all stages of which are described, was recently discovered attacking pines (*Pinus insignis*) in South Australia. Moths from pupae collected in December 1927 emerged in June and July 1928. It is probable that each female normally lays from 100 to 360 eggs on the pine needles. Newly hatched larvae were obtained in July and

mature larvae and pupae in December. The pupal period lasts nearly six months, and there is probably only one brood of moths, which occurs in late autumn or winter. Notes are given on the other species of *Chlenias* from Australia represented in the South Australian Museum.

MUNGOMERY (R. W.). **A Minor Sugarcane Pest** (*Plutorectis melanodes*, **M. & L.**).—*Queensland Agric. J.*, xxx, pt. 4, pp. 321–322. Brisbane, 1st October 1928.

The Psychid, *Plutorectis melanodes*, M. & L., was found on sugar-cane in Queensland. The larva lives in a tough case, which it carries from leaf to leaf. It is only a minor pest, since it feeds slowly, and the normal growth of the leaf more than counterbalances the injury caused. Pupation takes place within the case, which is suspended by silken threads from some part of the cane plant. Since the larvae remain on the tall cane and reach the adult stage during the spring and summer months, most of them are destroyed when the trash is burned either before or after harvest.

VEITCH (R.). **Report of the Chief Entomologist [1927-28].**—Fol., 8 pp. [Brisbane, Queensland Department of Agriculture, 1928.]

The work carried out by the Division of Entomology during the year 1927–28 is reviewed. Notes are given on the relative abundance of a number of pests mentioned in the previous year's report [*R.A.E.* A, xvi, 223]. *Listroderes obliquus*, Gyll. (*nociva*, Lea) (brown vegetable weevil) has recently been found attacking carrots and other vegetables in one district. A colony of *Trichogramma minutum*, Riley, an egg-parasite of the codling moth [*Cydia pomonella*, L.], was received from the United States and has been reared on the eggs of *Ephestia* sp. Colonies have been liberated, but so far no evidence of their establishment has been obtained. Experimentally the parasite has been bred from the eggs of *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), *Hellula undalis*, F., and *Heliothis obsoleta*, F.

An outbreak of the Coreid, *Leptoglossus bidentatus*, Montr., on *Citrus* was investigated, and it was found that the damage was done by the adults feeding on the petioles and fruit. As a result, large quantities of fruit fell prematurely. The bugs had bred on other food-plants and migrated to *Citrus*.

NEWMAN (L. J.). **Rutherglen Bug** (*Nysius vinitor*). **Order: Hemiptera. Family: Lygaeidae.**—*J. Dept. Agric. W. Aust.*, v, no. 3, pp. 322–324, 1 fig. Perth, W.A., September 1928.

The Lygaeid, *Nysius vinitor*, Bergr. (Rutherglen bug), causes considerable damage to crops, such as potatoes, tomatos, etc., in Western Australia. The adults, which are briefly described, can fly considerable distances. The eggs are laid in clusters on weeds or cultivated plants and hatch in 6–10 days. The five nymphal instars occupy about 24 days, but the adult bug is incapable of oviposition until 10 days after the final moult. Eggs are then deposited over a period of 3 weeks; one female may lay as many as 400. The adults are gregarious, and it is usually this stage that finds its way to cultivated

crops. At this time the weather is hot and dry, transpiration from the plant leaves is rapid, and the additional loss of moisture caused by the sucking of the bugs causes shrivelling of the leaves and consequent reduction of crop. Clean cultivation, the destruction of weeds on headlands, etc., and the maintenance of weed-free fallow for several weeks before planting, will render conditions unfavourable to the bugs. Contact sprays or dusts are effective, and formulae for turpentine, carbolic and nicotine sulphate emulsions are given, with instructions for their preparation. The bugs feed readily on a poison bait-spray consisting of $\frac{1}{4}$ oz. sodium arsenate dissolved in 3 lb. molasses or treacle and 1 gal. water. This spray can only be applied to weeds, straw or other material spread about for the purpose, as it scorches foliage. In experiments calcium cyanide dust was the most effective remedy, 25 lb. to the acre being used. Traps of rubbish may also be employed, the sheltering bugs being destroyed with a contact spray or boiling water, and the bugs may be jarred from the plants on to sheets of tarred canvas.

Newman (L. J.). **Report of the Economic Entomologist.**—*Ann. Rep. Dept. Agric. W. Aust. 1926–27*, pp. 26–27. Perth, W.A., 1927.

The seasonal prevalence of a number of insects, most of which have been previously noticed from Western Australia [*R.A.E.*, A, xiii, 456; xv, 25, 212, 350, 351], is discussed. No serious loss from insect pests was suffered during the season under review. An outbreak of *Brevicoryne* (*Aphis*) *brassicae*, L. (cabbage aphis) occurred in the inland areas, but in many instances the insect was beneficial, as it destroyed wild mustard and radish. In tests with a number of different soaps and essential oils, none proved of practical value for attracting the fruit-fly [*Ceratitis capitata*, Wied.]; the best results were obtained with a bait of pollard and borax at the rate of $\frac{1}{2}$ lb. each to 1 gal. water. The importance of crop rotation and plant sanitation is emphasised.

Dodd (A. P.). **The Biological Control of Prickly Pear in Australia.**—*Bull. Council Sci. Ind. Res.*, no. 34, 44 pp., 9 pls. Melbourne, 1927.

This is an account of the work undertaken by the Commonwealth Prickly Pear Board between 1920 and May 1927 [*cf. R.A.E.*, A, xv, 29; xvi, 27, etc.]. A description is given of the prickly pears of Australia, the formation of the Board and the scope of its work in North and South America, where a study of the natural enemies of these plants is being made, and in Australia, where the insects are bred and established in the open at various localities. The preferences of the different insects for various species of prickly pear are discussed, and a general account of them is given. The two most common species of *Opuntia* in Australia, *O. inermis* and *O. stricta*, are not naturally attacked in America by any of the insects yet found. The apparatus used and the methods of rearing the insects are described, and the difficulties connected with the rearing of some of the species are discussed; disease epidemics, usually caused by long periods of wet weather, may decimate the stock of an insect to such an extent that the results of two or three years' work may be destroyed.

A list is given of the various prickly pears and the insects that attack them. Those attacking the two principal species in Australia, *O. inermis* and *O. stricta*, are: the Pyralids, *Cactoblastis cactorum*, Berg, *Mimorista flavidissimilis*, Grote, *Melitara prodenialis*, Wlk., *M. doddalis*, Dyar, *M. dentata*, Grote, and *Olycella* (*M.*) *junctolineella*, Hulst; the Coreids, *Chelinidea canyona*, Hamlin, *C. tabulata*, Burm., and *C. vittigera*, Uhl.; the longicorn, *Moneilema* sp.; and the Coccids, *Diaspis echinodacti*, Bch., and three strains of the cochineal insect, *Dactylopius tomentosus*, Lam. *Melitara prodenialis* shows a preference for *O. stricta*, and the Coreids for *O. inermis*. The mite, *Tetranychus opuntiae*, Banks, introduced from Texas, is a valuable enemy of the latter; it spreads rapidly and reduces the plants to an unhealthy condition in which they are unable to form new growth and are easily destroyed by *Dactylopius tomentosus*.

CHRYSTAL (R. N.). **Comment on "The Infestation of *Sirex juvencus* in Canterbury, New Zealand."**—*Te Kura Ngahere*, 1928, pp. 21–22. Christchurch, N.Z., 1928.

This paper comments on the information contained in one already noticed [*R.A.E.*, A, xvi, 221] on *Sirex juvencus*, L., in New Zealand, drawing comparisons between it and observations on *S. cyaneus*, F., in Europe. Differences are pointed out in regard to the oviposition habits of the two species, including the larger number of eggs deposited in a tunnel by the latter and the greater depth of its oviposition tunnels in the wood, which are of importance in view of the activities of the Cynipid parasite, *Ibalia leucospoides*, Hochenw., which it is proposed to send out to New Zealand. It is pointed out in view of the fact that *S. juvencus* was not found attacking sawn lumber in New Zealand, that *Sirex* is known to occur in European timber yards, and *S. areolatus*, Cress., has been recorded as attacking seasoned redwood lumber in California. The fact that *Sirex* has been found to be polyphagous in New Zealand bears out European experience, as does the lightness of attack where the root system of the trees is deep.

The fungus, *Botryodiplodia pinea*, has been thought to be the possible forerunner of *Sirex* attack in New Zealand, but it is suggested that root rot may also be present, or that bad soil may be solely responsible for the susceptibility of the trees to the fungus. The possibilities attending the introduction of parasites of *Sirex* into New Zealand are discussed, those at present under observation in Britain being *Rhyssa persuasoria*, L., and *I. leucospoides*.

In reply to these comments, A. F. Clark confirms the lengths of the borings as recorded in New Zealand, and states that although there is no record of sawn timber being attacked in the province of Canterbury, such an attack has been recorded in North Island. Further work is being done in regard to oviposition habits.

UICHANCO (L. B.). **A Conspectus of injurious and beneficial Insects of Sugar Cane in the Philippines, with special Reference to Luzon and Negros.**—*Rep. Comm. Cane Varieties, Diseases & Fertilizers, 6th Ann. Conv. Philipp. Sugar Ass.*, reprint 16 pp., 14 refs. Manila, 1928.

Of the 91 species of insect pests dealt with in this report, the following are the more important.

Locusta (*Pachytylus*) *migratoria* ph. *migratoroides*, Rch. & F., and ph. *danica*, L. (*cinerescens*, F.) are occasionally injurious to the leaves of sugar-cane. Owing to the abundance at certain times of the year of *Gryllotalpa africana*, P. de B., *Gryllus testaceus*, Wlk., and *Acheta bimaculata*, DeG., they are presumed to be important pests of the roots.

Leucotermes philippinensis, Light, so far the only termite found to attack sugar-cane, is particularly injurious during protracted periods of drought and to cane with injured root systems ; healthy plants are not attacked. In regions of heavy infestation control measures should consist of planting as early as feasible so that the points may develop a good root system before prolonged drought sets in, previous soaking of the sets to hasten germination, irrigation during dry spells, and dipping the points prior to planting in a solution containing substances repellent or toxic to the termite—in this connection Paris green was definitely injurious, but a double emulsion of coal-tar and kerosene in soap solution promises to be of value. Tests with poison baits and various fumigants gave doubtful results.

Two unidentified species of thrips produce small red blotches on young leaves, particularly those of seedlings, which roll up longitudinally, the tips ultimately drying up. The removal and burning of affected parts reduce the damage.

Oregma lanigera, Zehnt. (woolly aphis), which is very common in the dry season, feeds on the lower surfaces of the more mature leaves of older cane. A small Chalcid parasite, *Encarsia flavoscutellum*, Zehnt., is being introduced from Java. *Trionymus sacchari*, Ckll., which often causes the death of very young canes, feeds on the softer tissues near the nodes and also occurs on the underground parts of the stem. The prevalence of red rot and a kind of foot rot can probably be attributed to this species. Remedial measures prior to planting consist of thorough removal of trash from the ground, as it was found to harbour the Coccid for a month or more, and of briefly immersing the points in a double emulsion of coal-tar and kerosene. The Derbid, *Proutista moesta*, Westw., is a serious pest of the leaves, especially of older plants, the punctures it makes being suspiciously associated with leaf spots caused by *Cercospora* spp. The Delphacids, *Eumetopina flavipes*, Muir, and *Perkinsiella vastatrix*, Bred., damage the midrib and leaf sheath by feeding and oviposition. Most of the information on the bionomics of the latter has previously been noticed [*R.A.E.*, A, xvi, 249].

The larvae of the Dynastid, *Alissonotum pauper*, Burm., injure the roots during the end of the rainy season and the beginning of the dry. Pupation occurs at a depth of 18 ins. in porous soils and lasted about 15 days in the laboratory. Larvae of the Rutelid, *Anomala humeralis*, Burm., have caused considerable damage in certain plantations during past years, but the Melolonthid, *Leucopholis irrorata*, Chevr., is probably the most injurious root grub of sugar-cane in Luzon and Negros. Much of the information on its bionomics has already been recorded [xiv, 94 ; xv, 552]. Oviposition occurs in the ground near its food-plant, though flooded parts of a field rich in organic matter are decidedly preferred. It is doubtful if the larvae attack living plants during the earlier instars, when they presumably feed on organic material, never moving far from the spot where they hatch. In order to eliminate sources of infestation for the subsequent crop, as soon as infested areas are discovered, they should be treated with calcium cyanide

granules, 10 gms. to a hill, buried about 4 ins. deep, or the hills should be dug up and the larvae destroyed. To delay the treatment is inadvisable, since pupation occurs at a depth of nearly 4 ft. soon after the death of the canes. The larvae of two species of *Autoserica* are occasionally injurious to the underground parts of cane ; the adults of a third destroy the leaves at night in some localities. Larvae and adults of *Dasus* (*Gonocephalum*) *depressus*, F., common in many localities during the dry season, destroy the sprouting eyes of planted points. In the laboratory the pupal period lasted 6–7 days. A double emulsion of kerosene and coal-tar was quite effective as a deterrent. A large percentage of canes in Negros Occidental contained numerous larvae, pupae and adults of *Rhabdocnemis* (*Sphenophorus*) *lineaticollis*, Heller. Infestation is often easily detected by the damage from rats, which apparently feed on the weevils. *Ceromasia sphenophori*, Vill., the Tachinid parasite of *R.* (*S.*) *obscura*, Boisd., has been introduced from Hawaii against *R. lineaticollis*.

About 80–90 per cent. of the moth borers occurring on sugar-cane are *Laspeyresia schistaceana*, Sn., which is apparently monophagous. The eggs are laid singly on the leaves or leaf sheaths. Soon after hatching, the caterpillars make their way between apposed sheaths into canes that are two to four months old, where they cause dead heart and the drying up of the middle unrolled leaf ; older stalks are invaded through the soft tissues of the eyes. When dislodged, they fall suspended on silk threads and can live for a few days on freshly fermenting stalks lying on the ground. Five parasites of this borer were found including *Trichogrammatoidea* (*Trichogramma*) *nanum*, Zehnt. The latter, together with the Scelionid, *Phanurus beneficiens*, Zehnt., also attacks the eggs of *Diatraea venosata*, Wlk., another fairly important pest of cane. *Scirpophaga nivella* (*auriflua*) var. *intacta*, Sn., lays its eggs in masses on the leaves. The young larva eats its way across through the roll of the youngest leaf ; it then mines downward through the leaf lamina into the heart of the plant. The older larvae are extremely sluggish and delicate ; if removed from inside the stem, they die through their inability to retunnel. *P. beneficiens* is one of its parasites.

Cirphis loreyi, Dup., is the only army-worm that is an actual menace to sugar-cane, owing to its becoming most numerous about March when late-planted canes will be attacked. *Portulaca oleracea* and certain wild grasses have been observed to serve as primary food-plants for the earlier instars, cane usually being eaten by fourth instar larvae. Liberations were made from two consignments from Hawaii of the Chalcid, *Euplectrus platyhypenae*, How., originally introduced into Hawaii from Mexico against the larvae of *Spodoptera mauritia*, Boisd., a minor pest of cane in the Philippines, and of the Scelionid, *Telenomus nawai*, Ashm., originally brought from Japan against the eggs of *Spodoptera*. Though these parasites are not yet known to attack any species of *Cirphis*, they may be of value, as *Spodoptera mauritia* is a serious pest of rice. A mynah bird (*Acridotheres tristis*) has also been imported from Honolulu against army-worms.

Among minor sugar-cane pests are the Noctuids, *Sesamia uniformis*, Dudg., and *Cirphis unipuncta*, Haw. ; the Pyralids, *Chilo infuscatellus*, Sn., and *Cnaphalocrocis medinalis*, Guen. ; the Hesperiid, *Parnara mathias*, F. ; the Lymantriid, *Laelia subrufa*, Sn. ; the Nymphalid, *Mycalesis mineus*, L. ; the Hispid, *Monochirus callicanthus*, Bates ; *Aphis maidis*. Fitch ; *A. sacchari*, Zehnt. ; and *Lophops carinatus*, Kby.

Pierce (W. D.). **Notes on the Sugar Cane Insect Situation in North Negros.**—*Sugar News*, ix, no. 9, reprint 12 pp. Manila, September 1928.

The more important pests of sugar-cane dealt with in this report are discussed at greater length in the preceding paper. Others include the mite, *Tetranychus exsiccator*, Zehnt.; the Coccids, *Odonaspis* (*Aspidiotus*) *secreta saccharicaulis*, Zehnt., and *Chionaspis saccharifolii*, Zehnt.; *Aleurolobus barodensis*, Mask., *A. longicornis*, Zehnt., and *Aleurodes lactea*, Zehnt., which occur in small numbers, many being parasitised; and a number of small moths, such as *Ereunitis* spp., and *Opogona dimidiatella*, Zell., which bore into the buds and rind, as well as various Lepidoptera attacking the leaves.

The green muscardine fungus, *Metarrhizium anisopliae*, is being obtained from Australia for distribution against *Leucopholis irrorata*, Chevr.

Otanes (F. Q.). **Some important Discoveries about Migratory Locusts in other Countries and their Application in the Philippines.**—*Philipp. Agric. Rev.*, xx, no. 4, pp. 477–485, 4 refs. Manila, 1927.

Recent work on the bionomics and periodicity of locusts is reviewed, and the importance of research on the breeding grounds and bionomics of *Locusta migratoria* ph. *migratorioides* in the Philippines is emphasised.

Theobald (F. V.). **Notes on** *Tetraneura hirsuta* **(Baker).**—*Entomologist*, lxi, pp. 221–223, 2 figs. London, October 1928.

Descriptions are given of the alate and apterous viviparous females of *Tetraneura* (*Dryopeia*) *hirsuta*, Baker, recorded from South India, Cape Province, Southern Rhodesia, Senegal, the Philippines, Japan and Formosa, attacking rice, barley, etc. The genus *Dryopeia* is regarded as a synonym of *Tetraneura*.

Aldrich (J. M.). **Five new Parasitic Flies reared from Beetles in China and India.**—*Proc. U.S. Nat. Mus.*, lxxiv, art. 8, no. 2753, 7 pp. Washington, D.C., 1928.

The species described are: the Ortalids, *Campylocera hirsuta*, sp. n., bred from Rutelids of the genus *Adoretus* in Formosa, and *Adapsilia flaviseta*, sp. n., from Rutelids in India; and the Tachinids, *Sigelotroxis parvus*, gen. et sp. n., from Rutelids in China, *Pexomyia genalis*, sp. n., from *Popillia japonica*, Newm., at Riverton, New Jersey (from material obtained in Japan), and *Centeter unicolor*, sp. n., from *Anomala sieversi*, Heyden, and *Phyllopertha* sp., from Korea. Keys are given to the genera *Centeter*, *Sigelotroxis* and *Pexomyia* and to the species of *Centeter*.

Murayama (J.). **The Mode of Attack and Tunnelling by** *Crossotarsus rengetensis* **Niijima et Murayama.**—*Insecta Matsumurana*, iii, no. 1, pp. 26–35, 5 figs., 10 refs. Sapporo, October 1928.

Of the fifteen Formosan Platypodids, *Crossotarsus rengetensis*, Niijima and Murayama [*R.A.E.*, A, xiii, 463], is the most important forest pest. In experiments with 60 different felled trees, it was found

to infest Lauraceae most and Fagaceae least (the latter is the family most attacked in southern Japan) and to prefer logs placed in the forest and on eastern slopes to those in sunnier situations. *Cinnamomum micranthum*, however, was attacked nearly as much in the outer as in the inner parts of the forest. The system of tunnels made by the adults in the timber is described. These were not found to contain other insects, but were lined with two layers of a black fungus. The adults do not feed much, but the larvae appear to eat the fungus.

The infestation of felled trees may be prevented by removing them as soon as possible from the forest to dry sunny places or by preserving them in water. Stripping off the bark only is ineffective.

Okuni (T.). **Report of the Studies on Stored Grain Pests. Part II.** [*In Japanese.*]—*Rep. Govt. Res. Inst. Dept. Agric. Formosa*, no. 34, 121 pp., 6 pls. Taihoku, Formosa, 1928.

In this second report on the pests of stored grain in Formosa [*cf. R.A.E.*, A, xii, 520], the beetles dealt with include *Tribolium castaneum*, Hbst. (*ferrugineum*, F.), *T. confusum*, Duv., *Palorus ratzeburgi*, Wissm., and *Gnathocerus cornutus*, F. Of these, the first-named is the most important, attacking rice, wheat, peanuts, dried maize and biscuits. It has four generations a year and passes the winter in the adult stage. The adults begin to mate 3 or 4 days after emergence and pair several times during life ; oviposition occurs 2 or 3 days later. The life of the beetle lasts from 104 to 374 days. Oviposition occurs from the middle of May to the end of October, one female laying on an average 86 eggs. The egg stage lasts 3–9 days, with an average of 5·8 at a temperature of 28·1 C. [82·5° F.], and 88·58 per cent. of the eggs hatched in an experiment. The larvae mature in 42–48 days, moulting 8 times, and the pupal stage lasts 4–9 days, with an average of 5. An unidentified Tenebrionid and *Lebia* sp. attack the adults and larvae.

The Nitidulid, *Carpophilus obsoletus*, Er., also attacks rice, wheat, peanuts, dried maize and seeds of *Sesamum*, causing serious damage in both the larval and adult stages. It has 5 or 6 generations a year, and every stage has been observed even in winter. Mating takes place about a fortnight after emergence and may occur several times. Oviposition begins about a week later, one female laying on an average about 80 eggs. The egg period varies from 2·8 to 19 days ; 84·3 per cent. of the eggs hatch in the period from April to October, and 28·5 in the remaining months of the year. The larvae mature in 36–59 days, the larval stage being slightly longer in the female. They usually moult 3 times, but sometimes only twice. The average life of the female is 207 days, and that of the male 168. The Pteromalid, *Aplastomorpha calandrae*, How. (*vandinei*, Tucker), has been observed in a cage in which *C. obsoletus* was being bred.

Prillwitz (P. M. H. H.). **Eenige opmerkingen betreffende het gebruik van carbolineum.** [Some Remarks on the Use of Carbolineum.] —*Arch. Theecultuur*, no. 1–2, pp. 26–32, 2 pls. Buitenzorg, June 1928. (With a Summary in English.)

Aulacaspis (*Sasakiaspis*) *pentagona*, Targ., occurred in large numbers on the green manure plant, *Crotalaria anagyroides*, on a tea estate in

Java, from which it spread to the tea. Satisfactory control of this Coccid may be obtained by washing the branches, after clean pruning, with a 12 per cent. emulsion of carbolineum.

Ultée (A. J.). [**Pests of Coffee and Green Manure Plants in 1927.**]—*Meded. Proefst. Malang*, no. 65, pp. 10–18, 41–42. Soerabaya, 1928.

The breeding of the parasite [*Prorops nasuta*, Wtrst.] of the coffee berry borer [*Stephanoderes hampei*, Ferr.] has been continued. The brown twig-borer, *Xyleborus morigerus*, Bldfd., has been observed attacking the roots of *Crotalaria*, lamtoro [*Leucaena glauca*], tea and other plants, penetrating deep beneath the soil. In this situation it is free from its Hymenopterous parasites. The latter are also parasites of the black twig-borer, *X. morstatti*, Hag. *X. morigerus* does not appear to occur in Sumatra, but *X. morstatti* is found there, and also probably in North and South Celebes. Both species occur in Java. Experiments showed that the removal of withered coffee blossoms is of little value against *Ferrisia* (*Pseudococcus*) *virgata*, Ckll. The Coccinellid, *Cryptolaemus montrouzieri*, Muls., was distributed against this pest, which does not seem to be fostered by ants. *Coccus* (*Lecanium*) *viridis*, Green, and *Saissetia* (*L.*) *hemisphaerica*, Targ., were also observed on coffee. It has been shown that the former is fostered by the gramang ant [*Plagiolepis longipes*, Jerd.], but trapping the latter in nests of leaves in trenches that are then closed and stamped down is of doubtful value. The same pests of green manure plants are recorded as in the preceding report [*R.A.E.*, A, xv, 610].

Kunhi Kannan (K.). [**Report of the Entomologist.**]—*Rep. Agric. Dept. Mysore 1926–27*, pp. 23–25. Bangalore, 1928.

The situation with regard to pests dealt with in previous reports [*R.A.E.*, A, xv, 358, etc.] is discussed. A hundred and twenty villages in Mysore have now joined the campaign against *Amsacta albistriga*, Wlk., and 155,726 moths were captured and destroyed during the year. Against the grasshopper, *Colemania sphenarioides*, Bol., bagging was carried out continuously. The result of destroying the earliest mango blossoms found infested with *Idiocerus* [*R.A.E.*, A, xv, 358] indicates that those so broken off will be replaced by other blossoms and not by leaf buds. The time taken for this replacement varies from 3 to 4 weeks, that is, sufficiently long for conditions encouraging mildew or hoppers to disappear. The second batch of blossoms may, however, suffer from the higher temperature of the more advanced season. Against *Oryctes rhinoceros*, L., on date palms, it is recommended that a number of healthy groves only should be selected and protected, the rest being destroyed. Against *Xylotrechus quadripes*, Chevr., hand-picking has been continued, and it has been decided to try an adhesive smeared on the coffee stems, but the difficulty is that the substance must retain its properties throughout the last quarter of the year, while the beetles are on the wing. The remedy suggested for *Chelidonium cinctum*, Guér. (citrus borer) [*R.A.E.*, A, xii, 61] when thoroughly carried out cleared the groves of the pest. Very little is known about *Adisura atkinsoni*, Moore, attacking avare [*Dolichos*]; hardly any pupae were found in fields heavily infested in the previous year, but infested

fields left unploughed may maintain large numbers to start the next year's infestation, and the moths are capable of long flights from such fields.

The Rice Bug.—*Leafl. Dept. Agric. Madras*, no. 50, 3 pp., 2 figs. Madras, 1928.

The rice bug [*Leptocorisa varicornis*, F.] pierces the stalks of tender earheads or the developing green grains of rice and sucks out the juices, sometimes causing severe losses to the rice crop in Madras. Certain small types of millet are also attacked. Breeding occurs on these plants and on various wild grasses. One female may lay from 250 to 300 eggs, which are placed in rows on the blades of rice or grass. They hatch in about a week, and in another fortnight the bugs become mature and can fly from field to field. The adult bugs may live for 3 or 4 months, ovipositing whenever suitable food-plants are available. On the west coast it is during the monsoons that the bugs breed and increase in numbers. The first rice crop, cultivated during the monsoons, is not much attacked, but the bugs that have bred on it concentrate on the second and third crops and cause enormous losses. The early strains and the first-formed ears are most severely attacked. As breeding occurs on wild grasses, clean cultivation and co-operation in destroying weeds are essential. If infestation is noticed in its early stages, the crop can be completely cleared with very little damage by sweeping a hand-net over the ear-heads for two or three days, morning and evening.

Ramachandra Rao (Y.) & Ramaswamiah (A. G.). **Notes on the Life-history of** *Longitarsus nigripennis*—**the "Pollu" Fleabeetle of Pepper.**—*Yearb. Dept. Agric. Madras 1926*, pp. 51–64, 1 pl. Madras, 1927. [Recd. 1928.]

Observations on *Longitarsus nigripennis*, Mots. [*R.A.E.*, A, xvi, 54] have been continued. The various stages are described. The adults excavate shallow elliptical holes in the berries of pepper [*Piper nigrum*]. Usually only one egg is laid in a hole, though sometimes two may be found. The larva hatches in 5–8 days and bores directly into the berry. By the end of a week or ten days, the contents of the berry are completely eaten, and the larva bites through its base and moves to the next one on the spike. Three or four berries may thus be eaten, and sometimes in moving from one to the other the larva may eat into the stalk of the spike causing the distal portion of it to dry up and turn black. The larval stage lasts 22–32 days [*cf. R.A.E.*, A, ix, 214], the active period of which varies from 18 to 28 days. Pupation occurs in the soil. The pupal stage lasts 6–7 days, but the adults remain in the cocoon for 2–3 days until the integument is hardened. The entire life-cycle lasts 37–49 days. In normal years the flushes appear in June and the berries begin to grow in July. The earliest oviposition was observed in the middle of July, the eggs giving rise to beetles at the end of August or beginning of September. The second generation may be expected in October, the third towards the end of November or beginning of December and the fourth in January. Under natural conditions the females are probably capable of laying 100 or more eggs, but as they are laid over a long period, the generations

overlap considerably. Both in the field and in cages oviposition ceased about the second half of December, at which time the berries usually become mature. This flea-beetle has not yet been found to breed on any other food-plant ; adults have been found on young pepper leaves in March, but what happens to them between March and July is not yet known ; neither larvae nor pupae could be found in the soil at this time. It is probable that they hide in cracks and crevices in the standards until the June rains occur.

Experiments with regard to remedial measures are still in progress ; the application of lime at the base of the plants and digging it in has not yet given any perceptible results against the pupae and larvae.

Ramachandra Rao (Y.) & Cherian (M. C.). **Notes on the Life-history and Habits of** *Elasmus nephantidis*, **Rohw.**— *Yearb. Dept. Agric. Madras 1926*, pp. 39–50, 1 pl. Madras, 1927. [Recd. 1928.]

Elasmus nephantidis, Rohw., the stages of which are described, is one of several parasites attacking *Nephantis serinopa*, Meyr. (black-headed coconut caterpillar) in South India. The eggs are usually laid on the host caterpillar when it is in the cocoon prior to pupation. After piercing the cocoon and paralysing the caterpillar, the female drops 10–20 eggs near it. The larvae hatch in 24–36 hours and attach themselves to the host. After about 4 days they congregate in a corner of the cocoon for pupation. The adult parasites emerge in 6–7 days and bite through the meshes of the cocoon. The total life-cycle lasts 10–16 days. The adults feed readily on sugar solution or honey water ; in nature they presumably feed on sweet secretions of plants and Aphids. The number of eggs recorded for individual females varied from 14 to 57.

The distribution of this parasite in Madras is discussed ; on the west coast it is attacked in the pupal stage by a Chalcid. Although *E. nephantidis* develops two or three times as rapidly as its host, it is not a very effective parasite as the period during which the host is attacked is very limited.

E. indicus, Rohw., has been reared from young caterpillars of *Diaphania* (*Margaronia*) *indica*, Saund., on snake gourd and has also been reported as attacking *Sylepta derogata*, F., on cotton. As *Elasmus* spp. appear to prefer Lepidopterous larvae, it is possible that the original record of this species from Coccids [*R.A.E.*, A, ix, 136] was erroneous and that it was reared from caterpillars of *Eublemma* sp., which are known to be predacious on *Anomalococcus indicus*, Green (acacia scale).

Ramachandra Rao (Y.) & Cherian (M. C.). **Notes on the Life-history and Habits of** *Parasierola* **sp.—the Bethylid Parasite of** *Nephantis serinopa*.— *Yearb. Dept. Agric. Madras 1927*, pp. 11–22, 1 pl. Madras, 1928.

A Bethylid, *Parasierola* sp., has recently been found to be of considerable importance in the control of *Nephantis serinopa*, Meyr., on coconut in South India. In several places in the Madras Presidency outbreaks of *N. serinopa* were usually found to disappear in a fairly short time owing to parasites of the different stages. The full-grown larvae are attacked by *Parasierola* sp., the smaller ones by *Apanteles*

sp., the larvae in cocoons by *Elasmus nephantidis*, Rohw., and the pupae by *Stomatoceras sulcatiscutellum*, Gir. In view of this, *Parasierola* and *Apanteles* have been introduced into Mangalore and have given fairly successful results. A detailed study of the biology of the former was carried out at Coimbatore. The adults are fairly strong fliers and can usually be found running about among the tunnels made by *N. serinopa* in search of the host. Mating took place within 1–2 days after emergence, and the eggs are apparently laid within 2 or 3 days in full-grown larvae, particularly those that are about to pupate inside the cocoon, 8 to 13 eggs being laid on one larva. In the cages the females laid from 8 to 12 eggs a day and lived for about 14 days; it is thought that under favourable conditions in the field they may live longer and lay a greater number of eggs. The larvae hatch in 24–48 hours, feed externally on the host and spin cocoons in its tunnel. The larval stage lasts 4–6 days, and the pupal stage about 4 days, the adult remaining in the cocoon 2 days before emerging. Although this species is a fairly efficient check on *N. serinopa*, it is itself so severely parasitised that unless its numbers are continually reinforced by breeding in the laboratory, it ceases to be of value towards the end of the season.

The parasites of *Parasierola* are a small black species, probably a Proctotrupid (which also attacks *Apanteles*), *Eurytoma* sp., *Pleurotropis* sp., and the mite, *Pediculoides ventricosus*, Newp.

In a number of districts *Parasierola* has proved an efficient check on *N. serinopa* in conjunction with *Apanteles*, and as this parasite and *Elasmus nephantidis*, as well as the Eulophid attacking the pupal stage [*R.A.E.*, A, xv, 128], can be very easily reared in the laboratory, numbers were bred for liberation in places where there were no parasites; in some areas, however, owing to the heaviness of infestation, satisfactory results were not obtained. An excess of humidity, such as occurs during the torrential rains of the south-west monsoon, and extreme dryness are both inimical to the parasites.

ANSTEAD (R. D.). **Application of the Pest Act to the Coconut Caterpillar.**—*Rep. Dept. Agric. Madras 1927–28*, pp. 58–59. Madras, 1928.

The efficiency of the parasites employed against the coconut caterpillar [*Nephantis serinopa*, Meyr.] appears to be dependent to a large extent on climatic conditions, and whereas in 1926–27 the Bethylid [*Parasierola* sp.] was very effective [see preceding paper], during 1927–28 the Eulophid, which attacks the pupae, was very successful.

SUNDARARAMAN (S.). **Mosaic Disease of Sugarcane in South India.**—*Bull. Dept. Agric. Madras*, no. 92, pp. 5–13, 2 pls. Madras, 1928.

In the section dealing with the agencies in the spread of mosaic disease of sugar-cane in Madras, mention is made of experiments and observations proving the occurrence of secondary infection. This suggests the existence of an insect vector. The insects observed on sugar-cane included *Aphis maidis*, Fitch, *A. sacchari*, Zehnt., and *Proutista* (*Phenice*) *moesta*, Westw. A series of preliminary tests showed that *A. maidis* will flourish on cane, but no definite results in transmission of the disease have yet been obtained.

Watts (H. C.). **Note on the Sal Borer Attack, 1927-28.**—*Indian Forester*, liv, pp. 587–594. Allahabad, November 1928.

During the year under report, the felling, conversion and burning of sal [*Shorea robusta*] attacked by the sal borer [*Hoplocerambyx spinicornis*, Newm.] in the Central Provinces were strictly confined to trees actually killed by the borer, in order that the limited supply of labour might be used to the best advantage. The adults began to emerge on 19th June, and the last beetles were caught on 27th July. Emergence began on a day of very heavy rainfall (3·26 inches) and reached its maximum during the middle of this period, especially on 6th and 7th July, following one inch of rain on 5th July. The felling of trap trees was begun on 19th June, immediately after the earliest rainfall of the monsoon. The trees chosen were those the removal of which was desirable from the silvicultural point of view, but which at the same time had not been so seriously attacked during the previous year as to be unattractive to the newly emerging beetles. Trees of over 3 feet in girth were usually chosen, since it was expected that these would prove more attractive than poles or saplings. It was found that within half an hour of felling, the beetles started to fly towards felled trees, collecting on the cut ends of logs to drink the oozing sap. Cases occurred in which more than a thousand beetles were killed on one tree during the first 24 hours after felling. During the second 24 hours, the beetles continued to be attracted in large but diminishing numbers, but after 48 hours had elapsed, the trees lost their power of attraction to a large extent. As soon as it was found that newly felled trees were the most attractive, it was decided to keep the size and number of trees felled as low as possible, attention being concentrated on catching the maximum number of beetles rather than on felling the maximum number of trees. The result was that whereas during the first fortnight 13,000 trees were felled and 37,000 beetles were killed, during the succeeding month until the operations were ended, 6,000 trees were felled and 383,000 beetles were killed.

The most effective way of catching the beetles consisted in removing the branch wood and cutting the trunk into a number of conveniently-handled logs about 8 ft. long. Such logging exposes several cut ends in each tree and increases the odour of the sap. The tree is then left, and the workers return once or twice during the next 24 hours to catch and kill the beetles. Towards the end of July there was a sudden decrease in the number of beetles caught, and operations were concluded on 7th August. Experience has shown that the barking of trap trees is ineffective and that all such trees should be logged, stacked, and burnt, with the exception of large logs capable of yielding railway sleepers. These should be barked and converted as rapidly as possible. Subsequent observations have shown that catching and killing the emerging beetles is an effective method of control where the supply of labour is sufficient to allow of intensive operations over limited areas.

Beeson (C. F. C.). **The Trap Tree Method.**—*Indian Forester*, liv, pp. 595–599. Allahabad, November 1928.

The relation of rainfall to the emergence of *Hoplocerambyx* [*spinicornis*, Newm.] and the efficacy of the trap tree method of catching the adults on emergence are further discussed [see preceding paper]. The range of attraction of the felled sal tree has been proved by experiment to extend

at least a quarter of a mile to the leeward and to be almost inoperative to the windward. The attractiveness of an exhausted trap tree may be revived to a certain extent by cutting it into logs, partially stripping the bark, or bruising the bark with the back of an axe, the first method being the most effective. For practical purposes the logging of a trap tree on the 2nd or 3rd day after felling is equivalent to the felling of a new tree. Experiments showed that larger trees attract and retain more beetles than smaller ones; in the case of trees 3 ft. to 3 ft. 6 ins. in girth, the attractiveness is 3 to 4 times greater than that of trees 2 ft. in girth, while the attractiveness of the latter is 3 times greater than that of trees 6 inches smaller in girth. Comparison of the number of beetles killed by the old method of stacking and burning trap trees and by the new method of catching and killing the adult beetles on emergence shows that the latter method is no less effective than the former and is the cheaper of the two if restricted to the period when the beetles are most numerous. The procedure recommended is to fell trees at the end of June, or when 10 inches of rain is recorded after 1st June (whichever is the earlier); to log the bole sufficiently to allow it to be rolled over; to collect beetles on the first and third days after felling; to re-log the tree on the third day, partially strip the bark and collect beetles on the fourth day; and then to leave the logs as a trap for eggs and burn them in the cold weather.

The belief that if no control measures at all were used against *H. spinicornis* an outbreak would subside naturally after all the unhealthy trees had been killed is erroneous. Sal has disappeared in certain localities, healthy and unhealthy trees of all sizes and ages being killed by an overwhelming attack of the beetles. On the other hand, when fewer beetles attack a perfectly healthy tree, the eggs and larvae are drowned in the resin exuding from the bark. The factors that have perpetuated the tree are the immunity to attack of the seedling, sapling and young pole stages and the limit imposed on the number of insects that can reach maturity in a single tree, which bears no relation to the number of eggs deposited in it.

Un parasite dangereux du dattier.—*Bull. agric. Algérie*, xxxiv, no. 11, p. 213. Algiers, November 1928.

Since the larvae of the Longicorn, *Pseudophilus testaceus*, Gah., have been intercepted in India in suckers of date palm [*Phoenix dactylifera*] from Iraq, the necessity for inspecting or prohibiting importations of date suckers from Mesopotamia to prevent the introduction of this pest into the French colonies is pointed out.

Tavares (J. S.). **As lagartas inimigas do milho.** [Caterpillar Pests of Maize.]—*Brotéria*, Sér. zool., xxv, no. 3, pp. 153–160. Caminha, 1st November 1928.

Notes are given on the chief Lepidopterous pests of maize in Portugal, *viz.*, *Laphygma* (*Caradrina*) *exigua*, Hb., *Pyrausta nubilalis*, Hb., and *Sesamia vuteria*, Stoll (*nonagrioides*, Lef.). Except in years of abnormal increase, none of these is of importance. Owing to the inclement weather in the spring of 1928, the appearance of the adults of *L. exigua* was delayed, and the extraordinary hot weather in early July hastened the hatching and the growth of the larvae, thus causing an outbreak. There are two or three generations a year, the last hibernating in the

pupal stage. *L. exigua* lives on the exterior of the plant, hiding by day among the young leaves. The colour of the larva varies with its food, and experimentally, light green larvae from maize turned almost black in one night when transferred to *Polygonum persicaria*. A return to maize caused the colour to lighten somewhat. A description of the larva, pupa and adult of *L. exigua* is given.

Pulselli (A.). **La** *Sphaerostilbe coccophila* **Tul. come parasita dell'** *Aonidia lauri* **Bouché e di altri insetti (Contributo allo studio dei funghi entomofagi parasiti di cocciniglie.** [*S. coccophila* as a Parasite of *A. lauri* and of other Insects. (A Contribution to the Study of entomogenous Fungi parasitising Coccids.)—*Bol. R. Staz. Pat. veg.*, N.S. viii, no. 3, pp. 262–283, 10 figs., 12 refs. Rome, 1928.

The biology and classification of *Sphaerostilbe coccophila*, Tul., are discussed, and an account is given of experiments with this fungus against the Coccid, *Aonidia lauri*, Bch., the conclusion reached being that this method of control is almost impossible of application in practice. The fungus is common in nature, but only develops spontaneously on insects under certain conditions, cold winters and dry summers being unfavourable to it.

Carughi (A.) & Paoloni (C.). **I mezzi chimici nella lotta contro le malattie delle piante. Fabbricazione, impiego, azione.** [Chemicals in Work against Pests and Diseases of Plants. Manufacture, Use and Action.]—Sm. f'cap. 8vo, xxx+358 pp., 7 figs., 6 pls., 32 refs. Milan, Ulrico Hoepli, 1928. Price, boards, *Lire* 18.

This book deals, particularly from the chemical point of view, with the composition, preparation and use of the fungicides and insecticides, including fumigants, in common use, many Italian products being specially noticed. Methods for analysing various commercial products are described. A list of the chief fungus and insect pests, with the measures appropriate in each case, concludes the volume.

Provasi (T.). **Elementi di parasitologia e terapia agraria. Parte I. I parassiti animali e i mezzi per combatterli.** [Elements of agricultural Parasitology and remedial Measures. Part I. Animal Pests and the Means for combating them.]—Sm. f'cap. 8vo, xiv+274 pp., 20 figs., 13 refs. Leghorn, Raffaello Giusti, 1928. Price, paper, *Lire* 10.50.

This manual of vegetable parasitology is intended for agricultural students in Italy. Almost the whole of this part is devoted to insects, and it deals with the various injurious and beneficial species, with brief notes on their bionomics and control. Formulae for a number of insecticides are given. An account of the Italian plant protection services and phytopathological legislation is appended.

Masi (L.). **Diagnosi di una nuova specie di** *Eunotus*.—*Boll. Soc. ent. ital*, lx, no. 8, p. 128. Genoa, 24th October 1928.

The Chalcid, *Eunotus festucae*, sp. n., was bred from the Coccid, *Eriopeltis festucae*, Boy., in Italy. It has also been obtained in Bohemia, France, Germany and Austria.

Grassé (P. P.). **Eudémis et plantes sauvages.**—*Prog. agric. vitic.*, xc, no. 49, pp. 541–544. Montpellier, 2nd December 1928.

Contrary to the general opinion, the larvae of the vine-moth [*Polychrosis botrana*, Schiff.] do not live exclusively on the grape-vine. The fruit clusters of *Daphne gnidium* and of wild vine harbour numbers of them, and they are occasionally found on gooseberries and currants, and a variety of other plants. Plants bearing clusters of flowers are preferred, but in the absence of flowers or fruit, they will infest the leaves and buds. In the laboratory the larvae are easily reared on herbaceous plants belonging to many different families. The exact part played by these wild plants in the propagation of *P. botrana* is not known. Recently, in the extreme south of France, the author found the larvae in small numbers on vines, while on *Daphne gnidium* in waste lands and pine-woods in the vicinity, they were present in hundreds and there was scarcely an uninfested fruit-cluster. These larvae were a deeper green than those on vines, and their development was more rapid; it is possible that a fourth generation occurred on *Daphne*. The author is inclined to think that *Daphne* exercises the greater attraction (probably a chemical one) for the moths at the time of oviposition. *D. gnidium* may perhaps be the original food-plant of *P. botrana*, though it does not occur in the Palatinate, where all the vineyards are infested. It is possible that *Daphne* could be used as a trap-crop, but provisionally it is recommended that it should be destroyed near vineyards as a potential reservoir of infestation. It is pointed out that estimates of the number of pupae sheltering under the bark of the vine-stock are not a reliable indication of future infestation, as they take no count of possible invasion from other food-plants.

Marchal (P.). **Etude biologique et morphologique du puceron lanigère du pommier, *Eriosoma lanigerum*, Hausmann.**—*Ann. Epiphyties*, xiv, no. 1, pp. 1–106, 37 figs., 106 refs. Paris, 1928.

This detailed study of the biology and morphology of *Eriosoma lanigerum*, Hsm., includes a history of the distribution of this Aphid and of its introduction into Europe and other parts of the world from America. An account is also given of the life-cycle in America and in Europe. Observations made by the author in France, confirmed by others made in Italy, Germany and Russia, show that the sexual generation occurring on *Ulmus americana* in America is incomplete in Europe, where the species is perpetuated on apple by means of uninterrupted parthenogenesis. The author attributes the record by Theobald of the migration of *E. lanigerum* to elm in England [*R.A.E.*, A, ix, 230] to confusion with a native species, *E. ulmosedens*, Marchal, which is probably identical with *E. patchiae*, Börner, and considers that Monzen probably encountered this same species when he reported migrations of *E. lanigerum* to *Ulmus campestris* in Japan [*R.A.E.*, A, xiv, 586].

It is known that sexuparous alatae do exist in Europe and are sometimes numerous on apple trees in autumn; and that these alatae have produced in captivity sexuales, the females of which, after mating, produced winter eggs. It has further been proved that these eggs can hatch and produce fundatrices. Studies, the technique of which are described, were undertaken in 1916 and 1927 to determine under what conditions and subject to what causes the rupture of the cycle produced in America on *Ulmus americana* occurs in Europe. The results showed

that although in France winter eggs deposited by a fertilised female in autumn can hatch the following spring and produce a fundatrix, she does not succeed in developing either on American elm or on apple. It is suggested that, owing to the long interruption in elm diet that has occurred since its introduction into France, a change may have occurred in the plasma of the species, and consequently in that of the fundatrix, involving incapacity to live on elm, even where American elm is available. Fundatrices obtained in experiments conducted in France with an imported American strain of *E. lanigerum*, however, also failed to develop on *Ulmus americana*. It is possible that climatic factors hinder regular hibernation, or vegetation may have failed to reach the stage necessary for the development of the fundatrices at the moment of their emergence. It is alternatively suggested that the death of fundatrices of both American and European strains even on American elms is due to the fact that these elms, while identified as *U. americana*, may not possess the pure characters of this species. Whatever the cause of the differences in the life-cycle of Aphids of American and European origin, these are of a sufficiently remarkable nature to constitute two races that are biologically distinct. The American strains on apple are distinguished by a heavy production of alatae at the end of the summer and in autumn, all of which are sexuparous, whereas in the European strains the alatae developing on apple are at first parthenogenetic and appear early, and later sexuparous. These alatae vary in numbers according to circumstances, but are generally much less numerous than those of the American strain.

The morphology and biology of the different forms occurring in the course of the cycle are studied in detail, and the immunity and resistance of various food-plants and the action of the Aphid on the plant are discussed.

VAYSSIÈRE (P.). **Sur un insecte d'origine exotique** (*Popillia japonica*, **Newm.**) **menaçant les cultures européennes.**—*C. R. Acad. Agric. Fr.*, xiv, no. 33, pp. 1086–1096, 2 figs., 15 refs. Paris, 1928.

The life-history, distribution and food-plants of *Popillia japonica*, Newm. (Japanese beetle) are discussed, and the larva and adult are briefly described. The organisation of the campaign against this pest in the United States is outlined, and the author points out the desirability of inspecting all imported plants, particularly when packed with earth, and establishing suitable disinfecting apparatus, to prevent its introduction into France.

The Black Currant Mite (Norfolk) Order of 1928.—1 p. London, 31st December 1928.

This is an Order of the Minister of Agriculture and Fisheries to the effect that the local authority for the Administrative County of Norfolk, or the County Borough of Great Yarmouth, on receiving a complaint from a grower of black currants, shall require the occupier of any land in the district on which black currant bushes are so affected with big bud, caused by *Eriophyes ribis*, Nal., as to be likely to cause the spread of the pest, to burn or destroy the affected branches, or otherwise effectively treat them. This Order came into force on 1st January 1929.

Staniland (L. N.) & Walton (C. L.). **The Long Ashton Tar-distillate Wash: Field Experiments, 1927-28.**—*J. Minist. Agric.*, xxxv, no. 8, pp. 731–740, 2 pls., 2 figs., 15 refs. London, November 1928.

In field trials carried out in three localities in Gloucestershire in February 1928, a tar-distillate wash made up at Long Ashton (the "high neutral" material emulsified with sulphonated oil [*R.A.E.*, A, xvi, 584]) and a proprietary wash, both used at 10 per cent. and 6 per cent. strengths, gave complete control of the apple sucker, *Psylla* [*mali*, Schmidb.]. The larvae of the winter moth [*Cheimatobia brumata*, L.] were commercially controlled by both washes at 10 per cent. strength, a slight superiority being noted in the case of the Long Ashton spray when used at 6 per cent. The 10 per cent. proprietary spray, while causing considerable reduction in the Capsid, *Plesiocoris* [*rugicollis*, Fieb.], did not give the same degree of commercial control as the Long Ashton spray at the same strength. Although the Long Ashton spray was still superior at 6 per cent., neither spray gave satisfactory control of the Capsid at that strength.

Trials to determine the effect of spray drift on undercrops showed severe twisting and crinkling of the foliage of beans sown in plots previously sprayed with an 8 per cent. tar distillate, though the germination of the seed was not affected. Crops sown up to 5 days after spraying were markedly lacking in vigour when ready for picking, whereas only the foliage of those sown later was affected, and they eventually grew normally. Beans on untreated plots showed no sign of Aphid infestation, but those weakened by spraying were severely attacked.

These results indicate that at least a week should be allowed to expire between spraying and the time of sowing beans under fruit trees. The type of damage described is most likely to occur where trees are sprayed exceptionally late or early. Cabbages planted on a plot sprayed with Long Ashton wash at 10 per cent. became markedly chlorotic, but later recovered their normal green colour and appearance.

Gimingham (C. T.) & Tattersfield (F.). **Laboratory Experiments with Non-arsenical Insecticides for Biting Insects.**—*Ann. Appl. Biol.*, xv, no. 4, pp. 649–658, 1 pl., 19 refs. London, November 1928.

During the past few years, laboratory experiments have been carried out to test the toxicity of various substances as stomach poisons to biting insects when applied to foliage as sprays. The technique adopted is described; the food-plant was sprayed and allowed to dry, and the caterpillars, etc., were confined on it in a hurricane lamp glass. It was found advisable to carry on experiments of this type for not less than 8–10 days; larvae surviving beyond the eighth day are usually capable of completing their development, except in cases where the substance used rendered the foliage very repellent. Several species of Lepidopterous larvae were used.

The results are not discussed in detail owing to a number of irregularities and discrepancies that will entail further work, but the results obtained with two dissimilar groups of compounds are briefly given. The silicofluorides of sodium, potassium, aluminium and calcium, used in solution or suspension in a 1 per cent. solution of saponin, showed considerable toxicity to young larvae, but the degree of resistance varied with different species and was greater with older larvae. Considerable,

but irregular, injury to foliage was noted. Foliage sprayed with extracts of certain tropical plants, namely *Tephrosia vogeli*, *T. toxicaria*, *T. macropoda* and black and white haiari (*Lonchocarpus* spp.) [*cf. R.A.E.*, A, xiii, 158; xiv, 512], was extremely repellent to young larvae. Even with high dilutions of the extracts, the foliage usually remained uneaten and the larvae eventually died of starvation.

Recent work on laboratory experiments with non-arsenical insecticides for biting insects is briefly reviewed.

Petherbridge (F. R.). **The Turnip Mud Beetles** (*Helophorus rugosus* **Ol. and** *Helophorus porculus* **Bedel.).**—*Ann. Appl. Biol.*, xv, no. 4, pp. 659–678, 1 pl., 8 figs., 6 refs. London, November 1928.

The following is taken largely from the author's summary :—

Helophorus rugosus, Ol., and *H. porculus*, Bedel., have caused serious damage to late sown white turnips in several cases in the east of England during the last few years. An instance in which the growing points of white turnips (planted out for seed growing) were eaten out by the larvae is recorded. Swedes and rape are damaged, but not to the same extent as white turnips. Kale and cabbages are only slightly injured, but lettuces were seriously damaged in Surrey in 1924. One case of an attack on beans by *H. rugosus* was also noticed. Most of the damage is caused by the larvae, which gnaw or tunnel into the " bulb " of the turnip, as well as feeding on the developing leaves. The adults also feed on the leaves.

Eggs are probably laid in August, and the larvae live from August until April or May. Pupation then takes place, the pupal stage lasting about three weeks. Adults were found from May until the following March. Descriptions of the larval, pupal and adult stages are given.

Since no case of severe attack was noticed on turnips sown before July, early sowing is recommended. Liability to attack is increased when cruciferous crops are grown at frequent intervals. Turnips should not be grown on or adjoining land infested in the previous year. Lettuce should not be grown on infested land. The seed beds of turnips and swedes raised for seed growing should not be on land where a cruciferous crop was planted in the previous year, since insect injury in the seed beds appears to be the primary cause of so-called " swede canker." As the larvae are feeding and growing in late summer, a late summer fallow should starve them. Cultural operations will probably be most effective if carried out when the beetles are in the pupal stage (about the last half of May in the east of England), most of the pupae being in the top 2½ inches of soil.

Oldham (J. N.). **The Metamorphosis and Biology of** *Rhynchaenus alni* **L. (Coleoptera).**—*Ann. Appl. Biol.*, xv, no. 4, pp. 679–698, 22 figs., 25 refs. London, November 1928.

During 1925 and 1926 considerable damage was caused to the foliage of elm trees in the vicinity of Warwick by *Rhynchaenus* (*Orchestes*) *alni*, L. This weevil is known to attack both *Ulmus campestris* and *Alnus glutinosa*. An historical review of the literature is given, and all stages of the insect are described. The winter is passed in the adult stage, usually under loose bark on the lower part of the trunk, but occasionally under leaves and plant refuse surrounding the trees. The weevils emerge during April and begin to feed on the buds and expanding leaves. Single eggs are laid in cavities bitten by the females

in the mid-rib or one of the larger veins, usually only one egg being deposited in each leaf. The larva hatches in about a week in early May, begins to feed in the vein and then attacks the parenchyma, mining between the upper and lower epidermis. It becomes full-grown in about three weeks and spins a cocoon within the mine. The pupal stage lasts approximately a week, and the first adults appear about the middle of June, feeding on the elm leaves until August, when they begin to seek hibernating quarters. The weevils usually feed on the lower surface of full-grown leaves, producing numerous shallow pits. The unconsumed epidermis gradually dies and becomes detached, leaving a hole in the leaf. The injuries caused by both larvae and adults have a serious effect on the foliage and upon the trees themselves, making them incapable of vigorous growth and even causing the death of the small lower branches. There appears to be only one generation a year in the Warwickshire area.

The following parasites were reared: the Braconid, *Sigalphus pallidipes*, Nees, the Pteromalid, *Habrocytus orchestis*, Ratz., and the Eulophids, *Tetrastichus cyclogaster* var. *obscurata*, Ruschka, *T.* (*Geniocerus*) sp., *Cirrospilus pictus*, Nees, *Pleurotropis* sp., *Pnigalio cruciatus*, Ratz., and *Chrysocharis orchestis*, Ratz. The first three species are primary parasites, the second three are secondary parasites, and the status of the last two is unknown. From the beginning of July onwards, the beetles became scarcer owing to increased parasitism, and by the third or fourth week of July the rate of parasitism was roughly estimated at 40 per cent. Trägårdh's key for the identification of the larvae of *R. populi*, F., *R. fagi*, L., and *R. quercus*, L., is appended, with minor modifications to include the larva of *R. alni*.

Theobald (F. V.). **Entomological Department.**—*Rep. Res. & Adv. Dept.* [*S.-E. Agric. Coll.*] *1927–28*, reprint 19 pp. [Wye, Kent, 1928.]

Notes are given on the incidence of insect pests in south-eastern England during the year ending 30th September 1928, which has been remarkable for severe damage by a variety of insects, Aphids being particularly numerous. The larvae of *Cladius pectinicornis*, Frcr. (rose sawfly) caused severe injury to strawberry foliage. A second brood occurs in August and September, when the best treatment is to cut the leaves close and burn them to the ground, measures which also largely control *Capitophorus fragariae*, Theo. *Sciara annulata*, Mg., attacked mushroom spawn in the open, this being the first record of its attacking mushrooms. *Plutella maculipennis*, Curt. (diamond back moth) was numerous on crucifers in Kent, where it appeared 3 weeks earlier than in 1926, all stages of the moth being present simultaneously. Two or more washes of nicotine and soft soap effected successful control, but this treatment was too costly in most cases. *Plesiocoris rugicollis*, Fall. (apple Capsid) has been extremely destructive in certain areas. A nicotine and soft soap wash, which reduced injury on long-stalked varieties of apple, is of little use for short strigged varieties.

Serious damage was caused to currants by Capsids, chiefly *Lygus pabulinus*, L. Other bush-fruits and strawberries, and in one case pears, were also attacked. Tar distillates proved useless against *L. pabulinus*, but good results were obtained by spraying first the bushes and then the soil beneath them with 10 oz. nicotine and 3 lb. soft soap to 100 gals. water; spraying the bushes alone was ineffectual as most of the Capsids fell to the ground without being hit. Damage

to hops was caused by *Lygus spinolae*, Mey. Larvae of *Hemerophila* (*Simaethis*) *pariana*, L., caused such serious damage to apple foliage that the development of the fruit buds was affected.

VAN POETEREN (N.). **Het optreden van de gamma-uilrups in het aardappelloof in 1928.** [The Occurrence of *Phytometra gamma* on Potato Foliage in 1928.]—*Tijdschr. PlZiekt.*, xxxiv, no. 10, pp. 267–270. Wageningen, October 1928.

Larvae of *Phytometra gamma*, L., occurred in large numbers in July 1928 in Holland, and both there and in Germany [*R.A.E.*, A, xvi, 690] the crop chiefly infested was potato. The outbreak was, however, speedily checked by birds, starlings being mainly responsible in Holland.

ZACHER (F.). **Die Spinnmilben der Himbeere.** [The Spinning Mites of Raspberry.]—*NachrBl. deuts. PflSchDienst*, viii, no. 11, pp. 103–104, 1 fig. Berlin, November 1928.

Raspberries in Germany often suffer loss of foliage owing to attack by *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.). It occurs in dry, sunny situations. *Neotetranychus rubi*, Träg., a description of which is given, is confined to *Rubus idaeus* and is never found except on raspberries under the shade of trees. For this reason it is not harmful, resembling in this another shade-loving mite, *T.* (*E.*) *fagi*, Zacher, which occurs, apparently exclusively, on the lowest branches of beech.

LÜSTNER (G.). **Zum Auftreten des Fichtennestwicklers,** *Epiblema tedella*. [The Occurrence of the Spruce Tortrix, *E. tedella*.]

LÜSTNER (G.). **Stärkere Schäden an Erdbeeren, verursacht durch den Liebstöckelrüssler und die Afterraupe der Erdbeerblattwespe.** [Serious Injury to Strawberries caused by *Otiorrhynchus ligustici* and *Blennocampa geniculata*.]

LÜSTNER (G.). **Der gefurchte Dickmaubrüssler** (*Otiorrhynchus sulcatus*, **Fabr.) an Cyclamen.** [*O. sulcatus* attacking Cyclamen.]—*Ber. Lehr- u. Forsch. Anst. Wein-Obst- u. Gartenbau 1926*, pp. 61, 61–62 & 63. Geisenheim a. Rh., 1927. (Abstracts in *Centralbl. Bakt.*, (2) lxxvi, no. 1–7, pp. 148, 154–155 & 157. Jena, 1st November 1928.)

The larvae of *Epiblema tedella*, Cl., hibernate on the branches of spruce, as well as on the ground litter [*R.A.E.*, A, xiv, 150].

The weevil, *Otiorrhynchus ligustici*, L., has caused considerable injury to strawberries in Wiesbaden by feeding on the leaves. It had migrated from lucerne, its preferred food-plant. Lucerne baits were used. The leaves and fruit of strawberries under glass were attacked by the sawfly, *Blennocampa geniculata*, Steph.

Otiorrhynchus sulcatus, F., was observed injuring *Cyclamen* in Wiesbaden.

DINGLER (M.). *Chalcographus*-**Frass in Weymouthskiefern.** [Injury to Weymouth Pine by *Pityogenes chalcographus*.]—*Forstw. Centralbl.*, lxxii, no. 11, pp. 357–360, 2 figs. Berlin, 1928.

Observations made in South Germany show that *Ips* (*Pityogenes*) *chalcographus*, L., attacks Weymouth pine [*Pinus strobus*] in preference

to spruce when the two occur together. As the bark of this pine is thin, the mines occur on the trunk of 26-year-old stems as well as on the branches. The second generation hibernates chiefly as adults, but also as larvae. Maturation feeding does not cease completely in winter, and some of the mature beetles of the second generation seem to leave their breeding-places before the new year.

Braune (R.). **Ueber die Entwicklung von** *Niptus hololeucus* **Falderm.** [Evolution of *N. hololeucus*.]—*Zool. Anz.*, lxxviii, no. 9–10, pp. 190–197. Leipzig, 15th September 1928.

Oviposition by *Niptus hololeucus*, Fald., normally takes place in September and October, but it has been noted by various authors as occurring in almost every month of the year. The complete cycle, from the egg to the death of the adult beetle, occupies about 200 days in Germany, the active life of the adult being sometimes as long as 2 months.

Reh (L.). **Das Verbot des Bleiarseniates.** [The Prohibition of Lead Arsenate in Germany.]—*Korr Bl. wirtsch. Schädlingsbekämpf.*, v, no. 1, reprint 1 p. Crossen a.d. Oder, 1928.

Reh (L.). **Eine dem deutschen Obstbau drohende Gefahr : Das Verbot des Bleiarseniates.** [A Danger menacing German Fruit-growing : The Prohibition of Lead Arsenate.]—*Gartenbauwirtschaft*, 16th February 1928, reprint 1 p.

These articles protest against the prohibition of the employment of lead arsenate as an insecticide in Germany, pointing out that no danger can result from its proper use.

Loos (K.). [**What Means are at Nature's Service to check the Formation of Insect Injury on a large Scale?**] *Sudetendeutsche Forst- u. Jagdztg.*, xxvii (1927), nos. 21–24, 28 ; xxviii [1928], no. 2. (Abstract in *Tijdschr. Pl Ziekt.*, xxxiv, no. 9, pp. 247–252. Wageningen, 1928.)

The effect of meteorological conditions in destroying insects in all stages is discussed, and it is concluded that in future great importance will attach to the recognition of their influence on forest pests. The investigation of these conditions has given little result hitherto, because of the difficulty of detecting the early stages of an outbreak, and because the increase of the pests usually takes place in tree-tops, under the bark, or in the ground. Reference is also made to the influence of natural enemies, such as birds and mammals, on outbreaks of insect pests.

Bovien (P.). **Lidt om Aebletraeets Knopviklere.** [Tortricids on Apple.]—*Gartner-Tidende*, 1928, reprint 1 p. Copenhagen, 1928.

Most of this information on the biology and control of *Eucosma* (*Tmetocera*) *ocellana*, Schiff., and *Argyroploce* (*Olethreutes*) *variegana*, Hb., has been already noticed from another source [*R.A.E.*, A, xv, 645]. Observations of other Tortricids attacking apple in Denmark, which include *Tortrix* (*Cacoecia*) *podana*, Sc., *T.* (*C.*) *rosana*, L., and

T. (*Pandemis*) *ribeana*, Hb., indicate that these species also probably hibernate in the larval stage, and not in the egg stage as has been previously suggested.

Siyazov (M. M.). **Сиязов (М.М.). The Results of Investigation into the Infestation of Cotton in Persia with foreign Pests.** [*In Russian.*]—*Khlopkovoe Delo*, vii, no. 9–10, pp. 740–747, 4 refs. Moscow, 1928.

An account is given of investigations made in Persia in 1927 and 1928 with a view to finding out whether the cotton regions of that country are infested with *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and other pests, and whether these are liable to spread into Russia. No larvae of *P. gossypiella* were found in the regions inspected, though in Bushire cotton seed was found apparently damaged by this pest. No investigations were made in the cotton region of southern Persia (Province of Mekran), to which it is thought that pests from India might easily migrate. In 1928 another important cotton pest, *Oxycarenus hyalinipennis*, Costa, occurred on wild Malvaceae and on cotton left in the fields throughout the winter.

Larvae of *Earias insulana*, Boisd., occurred in Kerman at the end of September and beginning of October 1927, 10 to 25 per cent. of the cotton bolls being infested. The larvae mine the young shoots, causing the buds to wither, and also bore into the flower buds, bolls and seeds, rendering them susceptible to fungi. Other malvaceous plants are also attacked. In 1928 moths appeared in Kerman at the end of May. The females live as long as a month, and each lays about 140 eggs. Oviposition lasts 4–5 days. The eggs are usually deposited on the flower buds and bolls and hatch within 3–12 days. This moth was probably introduced into southern Persia from India and was first observed in the areas inspected about two years ago. As the cotton bolls are picked entire in Persia, *E. insulana* is easily transported in the bags in which the bolls are kept, and very often pupates in them. It is able to withstand the rather cold climate of Kerman and could, therefore, also breed under the temperature conditions of the Russian cotton areas.

The Galerucid, *Rhaphidopalpa foveicollis*, Luc., a dangerous pest of melons, which had also migrated to the inspected districts from the south, was observed at the same time as *E. insulana*. The adult beetles hibernate on the ground under the fallen leaves of pistachio-nut trees and migrate in spring to the melon plantations, where they feed on the leaves; the larvae live in the soil and destroy the roots. The fruit-fly, *Myiopardalis* (*Carpomyia*) *caucasica*, Zaitz., a common pest of melons in Transcaucasia, also occurred in northern Persia.

Traut (I. I.). **Траут (И.И.). Results of Control Measures against *Locusta migratoria*, L., in the Lower Volga Region in 1926-27.** [*In Russian.*]—*Comment. Inst. Astrach. Def. Plant.*, ii, fasc. 2, pp. 1–16. Astrakhan, 1928.

A mass flight of *Locusta migratoria*, L., occurred in the Lower Volga region in 1926, the area infested with eggs being 346 sq. miles. The campaign in the following spring was very carefully organised, and some swarms escaped extermination only on a small area of about 148 acres. Considerable areas of egg-deposits were flooded in early

spring, and no locusts hatched there. The work has been done mainly by spraying ; other methods used were poison baits, dusting from aeroplanes and driving the locusts into ditches.

[Sakharov (N.).] **Сахаров (Н.) On the Study of the Resistance of Insects to Cold.** [*In Russian.*]—*Zh. opuitn. Agron. Yu.-Vostoka,* vi, no. 2, reprint 20 pp., 1 figs., 2 graphs, 1 map, 19 refs. Saratov, 1928. (With a Summary in German.)

This is a detailed description of experiments carried out in the Saratov Government to determine the resistance of various pests to cold, with particular reference to the larvae of *Euxoa segetum,* Schiff. Existing literature on the effect of low temperatures on insects is briefly reviewed. Experiments with the larvae of *Nygmia phaeorrhoea,* Don. (*Euproctis chrysorrhoea,* L.), *Melolontha hippocastani,* L., *Plagionotus arcuatus,* L., and *E. segetum,* the eggs and larvae of *Locusta migratoria,* L., and the adults of *Scoliopteryx libatrix,* L., and bees, showed that resistance to cold depends on the quantity of fat and free water contained in the bodies of the insects, those containing more fat freezing less readily. While the insects are preparing for hibernation, the amount of free water in their bodies, which freezes very easily, is reduced. The lethal freezing point of the hibernating stage of an insect depends entirely on the ecological conditions in which the particular instar lives and on its age at the moment of freezing. Any change of ecological conditions kills hibernating insects, whether they are prepared to withstand the cold or not. A temperature of —11·1° C [about 12° F.] killed all the eggs of *Locusta migratoria* in damp soil, while in dry soil only 76 per cent. were destroyed ; a temperature of —17·35° C. [about 1° F.] killed all the eggs in both instances. The resistance of the eggs of locusts in nature to very severe winters can be explained by the fact that the thick layers of snow prevent the temperature of the soil from falling to a point low enough to kill them. The critical temperature for larvae of this locust is —2·9° C. [about 27° F.], if they are exposed to it for not less than 6 hours. All the larvae died within 2 hours at a temperature of —5·75° C. [about 22° F.]. Early morning frosts do not affect young larvae, as they can withstand a temperature of —3° C. [26·6° F.] for three hours.

Laboratory and field experiments showed that in the region of the lower Volga, larvae of *E. segetum* are killed by autumn and winter cold. The lethal point for larvae hibernating in the upper layers of the soil is a temperature not lower than —5·75° C. [about 22° F.] ; for those in deeper layers it is between —7·8° C. and —11·1° C. [about 18 to 12° F.]. Owing to the fact that the larvae freeze under the severe temperature conditions of this region, the damage done by this pest is slight. It can be abundant only in places where there is a sufficient layer of snow during the winter to protect the soil from freezing, and where the winter is not severe and long. In the region discussed, however, snow falls only in the second half of the winter.

[Savzdarg (E. E.).] **Савздарг (Э.Э.). The Strawberry Mite and its Control in the Moscow Government.** [*In Russian.*]—*Sad i Ogorod,* 1928, no. 3, reprint 12 pp., 3 figs., 13 refs. Moscow, 1928. (With a Summary in English.)

Tarsonemus fragariae, Zimm., was first recorded in the Moscow Government in 1926, having probably increased of recent years owing

to favourable weather. It feeds on the young leaves of strawberry, causing them to dry up or, during wet weather, to rot. Heavy infestations greatly reduce the crop. The mite hibernates chiefly as an adult, but occasionally as a larva. Hibernation occurs at the base of the plants under the stipules, or sometimes under the edges of older leaves that are curled as a result of infestation. The females begin to oviposit about the middle of May, the eggs hatching in 9–13 days at 15–18° C. [59–64·4° F.]. Mass oviposition occurs in July and coincides with the picking of the fruit. Most of the mites occur in the centre of the leaf-buds, where they find the required shade and dampness. About the end of June the mites migrate to the young plants, on which they occur in large numbers in August, when transplanting is done. Mites may also be carried by insects or on clothes, etc. Females placed in water lived without food over a month, but in a dry place they died within six days. High humidity and close planting favour the development of *T. fragariae*. Wild and cultivated strawberry leaves are its chief food ; adults and eggs were also found on the leaves of *Alchemilla vulgaris* growing close to the infested strawberry beds. Infestation is heaviest in plantations 3 or 4 years old.

Various methods of control were tried. Sprays were not effective owing to the impossibility of reaching the centre of young leaves covered with thick hairs. Fumigation of seedlings failed to kill the mites until the plants were badly scorched. In the case of carbon bisulphide, however, the plants, if well cared for, may recover from the injury after 7–10 days. Dusting with various substances only killed a few mites, and, except in the case of flowers of sulphur, caused serious scorching of the plants. Disinfection of the seedlings was also tried, but they could not withstand immersion for more than 20 minutes in 5–10 per cent. kerosene emulsion, or 5 minutes in 1 per cent. formalin, under which conditions only 75 per cent. of the mites were killed.

Temporary measures include the burning of heavily infested strawberry plants and suckers and careful selection of seedlings ; plantations should be renewed every four years.

Osterwalder (A.). **Die Kräuselkrankheit der Erdbeeren.** [The Leaf-curl of Strawberries.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 23, pp. 395–398, 2 figs. Wädenswil, 10th November 1928.

Notes are given on the mite, *Tarsonemus fragariae*, Zimm. [*cf.* preceding paper], which is becoming of increasing importance as a pest of strawberry in Switzerland.

Papers noticed by Title only.

Horn (W.) & Schenkling (S.). **Index Litteraturae Entomologicae. Serie I. Die Welt-Literatur über die gesamte Entomologie bis inklusive 1863.** Bd. III, Leconte-Schaum, pp. 705–1056, 1 pl. Berlin-Dahlem, Dr. W. Horn. Price *Mk.* 18.75. [*Cf. R.A.E.*, A, xvi, 491.]

Kleine (R.). **Die Standpflanzen von** *Chrysomela sanguinolenta*, **L.** [The Food-plants of *C. sanguinolenta*.]—*Z. wiss. InsektBiol.*, xxiii, no. 8–9, pp. 190–195. Berlin, 31st October 1928. [Conclusion of *R.A.E.*, A, xvi, 690.]

Ripper (W.). **Die Raupe der Kohlschabe** (*Plutella maculipennis*, **Curt.**) **(Lep.).** [Description of Larva of the Cabbage Moth, *P. maculipennis*.]—*Z. wiss. InsektBiol.*, xxiii, no. 8–9, pp. 195–203, 8 figs., 6 refs. Berlin, 31st October 1928.

Schmidt (M.). *Stephanitis rhododendri* **Horv. (Hem., Ting.) in Deutschland.** [First Record in 1928 of *S. rhododendri* in Germany.] —*Z. wiss. InsektBiol.*, xxiii, no. 8–9, pp. 205–206. Berlin, 31st October 1928.

Common Names of Insects approved for general Use by American Economic Entomologists [six names].—*J. Econ. Ent.*, xxi, no. 5, pp. 788–789. Geneva, N.Y., October 1928. [*Cf. R.A.E.*, A, xvi, 268.]

Balachowsky (A.). **Contribution à l'étude des Coccides de l'Afrique mineure (4e note). Nouvelle liste de Coccides nord-africains avec description d'espèces nouvelles.** [Two new Species.]—*Bull. Soc. ent. Fr.*, 1928, no. 17, pp. 273–279, 8 figs. Paris, 1928. [*Cf. R.A.E.*, A, xvi, 200, 603, 669.]

Ferris (G. F.). **The wax-secreting Organs of the Coccidae.**—*Pan-Pacific Ent.*, v, no. 2, pp. 67–70, 22 refs. San Francisco, Cal., October 1928.

Murdock (G. E.). **The wax-secreting Mechanism in the adult Female of** *Icerya purchasi* **Maskell.**—*Pan-Pacific Ent.*, v, no. 2, pp. 71–75, 2 figs. San Francisco, Cal., October 1928.

Knowlton (G. F.). **Notes on a few Species of Macrosiphini (Aphididae) from Utah with Descriptions of two new Species.**—*Pan-Pacific Ent.*, v, no. 2, pp. 79–84, 4 figs. San Francisco, Cal., October 1928.

Dyar (H. G.). **Notes on Cactus Moths allied to** *Melitara*, **with two new Genera and one new Species.**—*Proc. Ent. Soc. Wash.*, xxx, no. 8, pp. 133–137. Washington, D.C., 9th November 1928.

Ferris (G. F.). **Observations on the Chermidae** [Psyllidae] **(Hemiptera: Homoptera). Part V.**—*Canad. Ent.*, lx, no. 10, pp. 240–245, 3 figs. Orillia, Ont., October 1928. [*Cf. R.A.E.*, A, xvi, 544.]

Leplae (E.). **Le scolyte des baies du caféier** (*Stephanoderes* [*hampei*, Ferr.]).—*Bull. agric. Congo belge*, xix, no. 2, pp. 271–276, 1 fig. Brussels, June 1928. [*Cf. R.A.E.*, A, xvi, 535.]

Leplae (E.). **Le ver rose du coton** [*Platyedra gossypiella*, Saund.] **dans la région du lac Kivu.**—*Bull. agric. Congo belge*, xix, no. 2, pp. 262–270, 6 figs. Brussels, June 1928. [*Cf. R.A.E.*, A, xvi, 535.]

Regulations for the Enforcement of the Insecticide Act of 1910.—*U.S. Dept. Agric., Food, Drug and Insect. Admin.*, S.R.A., I.F. no. 1, 12 pp. Washington, D.C., October 1928.

Hansen (H. N.). **Endosepsis** [spread by *Blastophaga psenes*, L.] **and its Control in Caprifigs.**—*Phytopathology*, xviii, no. 11, pp. 931–938, 2 figs., 9 refs. Lancaster, Pa., November 1928. [*Cf. R.A.E.*, A, xvi, 319, etc.]

Boyce (A. M.) & Fawcett (H. S.). **An** *Aspergillus* **attacking Mealybugs in Insectaries in Southern California. (Abstract.)**—*Phytopathology*, xviii, no. 11, p. 948. Lancaster, Pa., November 1928.

Handschin (E.). **Praktische Einführung in die Morphologie der Insekten. Ein Hilfsbuch für Lehrer, Studierende und Entomophile.** [A Practical Introduction to Insect Morphology. A Text-book for Teachers, Students and Insect Lovers.]—8vo, viii+112 pp., 23 pls. Berlin, Gebrüder Borntraeger, 1928. Price *M.*11.

FAES (H.). **Station fédérale d'essais viticole à Lausanne et Domaine de Pully. Rapport annuel 1927. A. Division de physiologie et pathologie végétale.**—*Annu. agric. Suisse*, xxix, no. 4, pp. 456–466. Berne, 1928.

Gall forms of *Phylloxera*, which in south-eastern Switzerland only occur spasmodically under peculiarly favourable climatic conditions, appeared there in large numbers in 1927, the climate prevailing in Central and Eastern Europe at the end of 1926 having presented the factors required for the production of the winter eggs from which they arise. Laboratory experiments carried out in 1927 showed that galls did not develop on potted vines that had been immersed in February for twelve hours in a solution containing 3 per cent. potassium sulphocarbonate and 1 per cent. soft soap, while untreated ones were covered with them. Field experiments in which vines were sprayed in March with lime-sulphur, 1 : 4, or with a 4 per cent. solution of crude lysol, gave equally good results, and spraying with the latter mixture is therefore recommended for the destruction of the winter eggs of *Phylloxera*.

Other pests to which attention was devoted during the year were the vine-moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., *Cydia* (*Carpocapsa*) *pomonella*, L., and several of the orchard pests noticed in the preceding report [*R.A.E.*, A, xvi, 169].

RUSZKOWSKI (J.). **Rolnica Zbozówka—Szkodnik ozimin i buraków.** [*Euxoa segetum*, Schiff., a Pest of Winter Crops and Beets.]—4 pp., 5 figs. Warsaw, Sta. Ochr. Róslin Tow. Ogrodn. Warsz. [1928.]

This is a short and popular account of the bionomics and control of *Euxoa* (*Agrotis*) *segetum*, Schiff., which caused very severe damage to beets and vegetables in Poland in 1928. The adult moths, which only fly at night, occur in summer, and lay their eggs on weeds, on which the larvae feed for a time, afterwards migrating to cultivated plants. They feed on the leaves during the night, remaining during the day on the ground under fallen leaves and amongst roots. At the approach of the first frost, they bury themselves in the soil for hibernation, resuming their activity in spring. When mature, they pupate in the soil. To prevent the larvae from migrating, a furrow, 8–10 ins. deep, should be ploughed round the infested fields, with pits made at intervals of 12–16 ins., into which the larvae fall and where they can easily be killed. Bunches of weeds dusted with arsenic or Paris green and placed in infested plantations and the ditches round them are effective baits. Fowls should be allowed to feed in infested fields, and insectivorous birds and mammals should be protected. The adult moths may be trapped in buckets containing equal parts of molasses and water.

RUSZKOWSKI (J. W.). **Blyszczka jarzynówka jako grózny szkodnik pól i ogrodów.** [*Phytometra gamma*, L., a serious Field and Vegetable Pest.]—*Poradnik Gospod.*, xxxix, no. 31, pp. 730–732. Posen, 29th July, 1928; also in *Klosy*, xxi, no. 32, pp. 782–783. Thorn, 5th August, 1928; [abridged as:] *Ulotka Sta. Ochr. Róslin Tow. Ogrodn. Warsz.*, no. 14, 2 pp., 5 figs. Warsaw [1928].

A serious outbreak of *Phytometra* (*Plusia*) *gamma*, L., occurred in Poland in 1922, and in July 1928 the moths appeared again, especially

in the western districts. The larvae feed on leaves of cruciferous and papilionaceous weeds, but very often attack potatoes, flax and other cultivated plants. They are sometimes extremely abundant, covering the roads and hedges and causing as much damage as locusts. They spin webs round the leaves, in which they pupate, the adults emerging in a fortnight. Natural enemies control this moth to a certain extent, but in some cases it has infested the same places for several consecutive years.

Remedial measures recommended include : Collecting the larvae by hand or by sweeping, or shaking them to the ground and crushing them ; hand-picking the pupae ; spraying with Paris green and lime ; catching the moths with nets, and driving them from the fields by burning a mixture of dung and sulphur in places where mass oviposition is likely to occur; digging ditches to prevent migration of the larvae ; and sowing cruciferous weeds as trap-crops. Poultry should be allowed to feed in the infested fields.

Woroniecka (J.). **Spostrzeznia nad szkodnikami roślin uprawnych, występującemi w woj. Lubelskiem i części Kieleckiego w latach 1926 i 1927.** [Observations on the Pests of Cultivated Plants that appeared in the District of Lublin and in a Part of the District of Kielce during the Years 1926 and 1927.]—*Mém. Inst. nat. polon. Econ. rur. Pulawy*, ix, pt. 1, pp. 216–251, 17 refs. Pulawy, 1928. (With a Summary in English.)

In 1926 and 1927, considerable injury was done to young apple trees by the larvae of *Hemerophila* (*Simaëthis*) *pariana*, Cl., which also attacked cherry, but infestation by *Cydia* (*Laspeyresia*) *pomonella*, L., and *Anthonomus pomorum*, L., was less important than in previous years. Of the sawflies, *Hoplocampa fulvicornis*, F., attacked plums, *Neurotoma flaviventris*, Retz., occurred in great numbers on pear and cherry, and *Pristiphora pallipes*, Lep., caused serious damage to gooseberries. *Aphis pomi*, DeG. (*mali*, F.), infesting apple, was destroyed in 1927 by the fungus, *Empusa fresenii*. The damage done in 1927 by *Psylla mali*, Schmidb., was also slight, as cold weather in April killed many of the young nymphs. This Psyllid was parasitised in autumn by an Encyrtid, *Prionomitus* sp. The parasites continued to emerge until nearly the end of October ; in November no adults emerged, although numerous larvae and pupae remained in the skins of the dead Psyllids.

Smynthurus (*Deuterosmynthurus*) *repandus*, Argen, injured beet and chrysanthemums. Mustard was attacked by *Athalia colibri*, Christ (*spinarum*, F.), which destroyed the leaves, buds, flowers and pods of the plants. *Pyrausta nubilalis*, Hb., caused serious damage to millet, each larva destroying numerous plants, but did not attack maize even when growing near millet. The injury done to peas by *Cydia* (*Laspeyresia*) *nigricana*, Steph., depends a great deal on the weather conditions during the summer ; when the spring is early, a second generation occurs, the adults emerging by the end of July or beginning of August. Although the larvae of *Cnephasia* (*Tortrix*) *wahlbomiana*, L., chiefly feed on weeds, they occurred also on poppies, beginning to pupate amongst the injured leaves in the second half of June. *Ochsenheimeria taurella*, Schiff., attacked the ears of rye, but the damage done was not considerable. The adults occurred in the middle of July. *Opomyza florum*, F., was noticed in 1927 for the first time as a serious pest of winter wheat, but was only abundant during the spring in fields

adjoining meadows. The adults emerged in June. The damage done by *Oscinella* (*Oscinis*) *frit*, L., and *Chlorops taeniopus*, Mg., was less than in previous years, although the crop of spring wheat was considerably reduced by the latter. Beet and cabbages were damaged by *Tipula paludosa*, Mg., *Pachyrrhina maculata*, Mg., and *P. pratensis*, L., which have only one generation a year in Poland, the adults occurring in August. *Bibio hortulanus*, L., was especially abundant in 1926 on vegetables and also attacked cereals. *Aphis papaveris*, F., infested beet, beans and poppies, greatly reducing the crop. Both in 1926 and 1927 an epidemic of *Empusa fresenii* in June killed all the Aphids in a few days. *Blaniulus guttulatus*, Gerv., was especially injurious to cucumbers. The larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) were very destructive in vegetable and nursery gardens during 1926, and early in May 1927 the adults emerged and attacked the foliage of forest and other trees. *Pieris brassicae*, L., was so abundant in 1927 that control measures could not prevent the majority of its food-plants from being entirely destroyed by the caterpillars. *Apanteles glomeratus*, L., was not sufficiently abundant to check them, but in the beginning of September almost all of them were killed by the fungus, *Entomophthora sphaerosperma*. *Psylliodes attenuata*, Koch, attacked young hops; it is especially harmful when weather conditions retard the normal development of the plant. Hops were also heavily infested by *Phorodon humuli*, Schr., and *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.).

ROZSYPAL (J.). **Hnědý mol jabloňový** (*Simaëthis pariana*, *Cl*), **škůdce jabloní na Moravě v roce 1927 a 1928.** [*Hemerophila pariana*, Clerck, as a Pest of Apple-trees in the Moravia Area in 1927–28.] —*Ochr. Rost.*, viii, no. 5, pp. 113–116, 4 figs. Prague, 1928.

The larva, pupa and adult of *Hemerophila* (*Simaëthis*) *pariana*, Clerck, are briefly described, with notes on its habits and distribution. This moth occurred in large numbers in Czechoslovakia in 1927–28, attacking apple and sometimes pear. It has two generations a year, hibernating chiefly in the adult stage, though a small number of pupae also survive the winter. The hibernating adults are found in sheltered places, such as cracks in the bark of trees. It is thought that the eggs are laid on the developed leaf-buds, on which they hatch in May, since the buds are always the first to suffer from the attacks of the larvae. By the end of June and beginning of July most of the larvae pupate, the pupal stage lasting about 10 days. In the course of September the larvae of the second generation appear; these do much more damage than those of the first. Besides feeding on the leaves, they often attack the fruit, spoiling its appearance. *Pimpla maculator*, F., and *Apanteles impurus*, Nees, have been recorded in Czechoslovakia as parasites of *H. pariana*. Arsenical sprays should be applied as soon as the eggs hatch and before the leaves have been curled by the young larvae. The larvae may also be shaken off the trees and adhesive bands applied.

MAGERSTEIN (C.). **Škodliví činitelé na kosikářské vrbě v r. 1927.** [Pests of Willows in 1927.]—*Ochr. Rost.*, viii, no. 5, pp. 128–130. Prague, 1928.

On the whole, climatic conditions in 1927 were very favourable to the growth of willows in Czechoslovakia and reduced the importance

of insects and fungi attacking them. *Galerucella lineola*, F., occurred on the young shoots. The damage done by *Phyllodecta* spp., *Lochmaea capreae*, L., and *Melasoma* spp. was less than in preceding years. Sawfly larvae skeletonised the leaves, chiefly those of *Salix americana*. *Cryptorrhynchus lapathi*, L., occurred in great numbers in dry places throughout the whole summer; the adults attacked *S. americana* and *S. amygdalina*, and the larvae fed on the stems of various other willows. *Earias chlorana*, L., occurred in some places on *S. viminalis*, and considerable numbers of *Peronea* (*Acalla*) *hastiana*, L., attacked narrow-leaved willows.

Zacher (F.). **Weitere Mitteilungen zur Biologie von** *Niptus hololeucus*. [Further Contributions to the Biology of *N. hololeucus*.]—*Zool. Anz.*, lxxix, no. 9–12, pp. 269–272, 4 refs. Leipzig, 15th December 1928.

The author's observations confirm those of other workers that *Niptus hololeucus*, Fald., oviposits almost throughout the year, though eggs are laid in large numbers only in September. During July and August no eggs were noticed.

The adults were found to feed on various foodstuffs, dead insects, etc., and to eat holes in silk, artificial silk and woollen, cotton and linen materials; they also drank water eagerly. Larvae fed on wool soon died. The adults may live as long as 158 days. The natural enemies of *N. hololeucus* include *Pediculoides ventricosus*, Newp., and another unidentified mite.

Torka (V.). *Chlorops taeniopus*, **Meig., als Weizenschädling.** [*C. taeniopus* as a Pest of Wheat.]—*Z. Ent.*, xvi, no. 1, pp. 4–5. Breslau, 1st February 1928.

Examination of the ears of wheat in Upper Silesia revealed a loss of 40 per cent. of full grains owing to infestation by *Chlorops taeniopus*, Mg. The fly is parasitised by a Braconid, *Coelinius niger*, Nees, the larvae of which occur in the pupae, and by various Chalcids, which have ectoparasitic larvae. No satisfactory method of controlling this fly is known, though some advantage may be obtained by sowing plots of wheat as early as August and then ploughing them under when oviposition has occurred.

Zwölfer (W.). **Ergebnisse der Maiszünsleruntersuchungen in Süddeutschland.** [Results of the Investigations on *Pyrausta nubilalis* in South Germany.]—*Mitt. deuts. Landw.-Ges.*, xliii, p. 267, 1928. (Abstract in *Centralbl. Bakt.*, (2) lxxvi, no. 8–14, pp. 280–281. Jena, 26th November 1928.)

About 8,000 acres are under maize in Baden, and *Pyrausta nubilalis*, Hb., occurs over nearly the whole area, causing a crop loss of 5–10 per cent. The larvae that have hibernated pupate from mid-June to early July. Most of the moths are on the wing at the end of July and oviposit chiefly on maize advanced in development. The larvae hatch in about 8 days. After harvest, the maize plants should be removed entire so that no shelters remain in the field. Three Hymenopterous parasites, including *Microgaster tibialis*, Nees, have been observed.

VON DOBKIEWICZ (—). **Zur Biologie der Speckkäfer.** [A Contribution to the Knowledge of the Bacon Beetles.]—*Mitt. Ges. Vorratsschutz*, iv, no. 6, pp. 68–70. Berlin, November 1928.

Two years' breeding experiments were carried out with *Dermestes frischi*, Kug., and *D. vulpinus*, F., found in 1926 in a case of skins imported into Bavaria from Canada. Larvae and adults thrived when fed on smoked meat, cakes, or dried cheese, but could not survive on a diet of fat; neither species can feed on bacon. In later experiments the food was dry.

The habits of both species are similar, but *D. vulpinus* is more active and more prone to cannibalism. The younger larvae are devoured by the parents, and older larvae readily eat fresh pupae. The eggs are laid singly or in batches of 2–4 in cracks, etc., and if such shelters are not available, mating and oviposition cease. In 8 days a pair does not usually produce more than 6–8 larvae, though exceptionally up to 60 eggs have been deposited in 10 days. The larvae hatch in 2 or 3 days and at once begin to wander. After 2 days the first moult takes place and feeding begins. At 28–30° C. [82·4–86° F.] 5 moults occur at intervals of 5 days. There is an interval of 8–12 days between the last moult and pupation. Four days before pupation, the larvae cease to feed and wander in search of shelters for the delicate pupae. They are then capable of boring into hard materials such as wood. The total development lasts 42–46 days. Hybrids between the two species can be obtained.

Under favourable conditions these Dermestids can produce six generations a year. They spread by means of the wandering of the newly-hatched and mature larvae and the occasional weak flights of the adults.

FRIEDERICHS (K.). **Waldkatastrophen in biozönotischer Betrachtung.** [Catastrophic Outbreaks of Forest Insect Pests considered from the Aspect of Biocoenosis.]—*Anz. Schädlingsk.*, iv, no. 11, pp. 139–142, 14 refs. Berlin, 15th November 1928.

Consideration of the serious outbreaks of forest pests in Europe during the past hundred years shows that the factors producing such outbreaks (climate, environment, etc.) though varied, are interrelated and should be regarded as a whole. The suggestion that outbreaks are due to the growing of a single kind of plant over large areas is only an hypothesis, as too little is known about the causes of such increases. Though mixed stands are desirable wherever possible, their importance should not be overrated. Increases of insects are really a normal occurrence, and only become abnormal when unduly concentrated. The destruction by pests of trees in natural forests must be regarded as a natural regeneration that clears the ground for new growth. This also applies in cultivated forests, except that it is not a matter of trees that are no longer adapted, but of artificially introduced trees that were never adapted to the existing environment.

Locusts provide an example of this. Though serious pests in cultivated regions, they are far from being so in the steppes, where they clear away bushes, perennial plants, and old grasses, so that when the rains come fresh, green pastures arise.

PAX (F.). **Beobachtungen über das Auftreten des Nelkenwicklers (*Tortrix pronubana*, Hb.) in Schlesien.** [Observations on the Occurrence of *T. pronubana* in Silesia.]—*Anz. Schädlingsk.*, iv, no. 11, pp. 143–147, 4 figs., 13 refs. Berlin, 15th November 1928.

An infestation of carnations, both under glass and in the open, by *Tortrix pronubana*, Hb., was observed at Breslau in 1928, as a result of its introduction with carnations imported in 1925 from the Italian Riviera. The moths were active in sunshine, remaining settled on the plants in dull weather. *T. pronubana* is a Mediterranean species, and this appears to be the first record of it from Germany. It seems to confine itself to carnations. Hand collection should be supplemented by a spray to destroy the newly-hatched larvae. This moth is unlikely to become established on carnations in the open in Silesia owing to the climate.

ZACHER (F.). **Nahrungsauswahl und Fortpflanzungsbiologie der Samenkäfer. Vorläufige Mitteilung.** [The Choice of Food and Biology of Reproduction in Seed-infesting Beetles. Preliminary Communication.]—*Anz. Schädlingsk.*, iv, no. 11, p. 148. Berlin, 15th November 1928.

Though Bruchids usually infest leguminous seeds, they are not confined to plants of this order. There are two groups: one with larval development in immature, growing seeds, and the other found exclusively or predominantly in ripe seeds. *Bruchus pisorum*, L. (*pisi*, L.) belongs to the first group, and *B.* (*Bruchidius*) *obtectus*, Say, to the second. The adults do not always feed, though feeding increases the number of the eggs. The larvae usually have a series of more or less closely related food-plants. *Spermophagus subfasciatus*, Boh., develops in the seeds of various beans (*Phaseolus* spp.), *Voandzeia subterranea*, *Vigna sinensis*, *Cajanus indicus*, *Dolichos lablab*, *D. sesquipedalis*, *Cicer arietinum*, and peas. The larvae can also develop in *Glycine hispida*. They can bore into other leguminous seeds, even the poisonous ones of *Abrus precatorius* and *Physostigma venenosum*, but die on eating the cotyledons. Only very small seeds (*Trifolium*) or strong-smelling ones (*Dipteryx odorata*) are avoided for oviposition. Eggs are even laid on seed of the castor-oil plant [*Ricinus communis*] and maize. Females bred from peas prefer bean seeds for oviposition, so that the host selection principle does not apply.

OPMANIS (K.). **Ein Beitrag zur Kenntnis der Aphidenfauna Lettlands.** [A Contribution to the Knowledge of the Aphid Fauna of Latvia.] —*Acta Univ. Latviensis*, xviii, reprint 154 pp., 7 figs., 4 pp. refs. Riga, 1928.

This paper deals with Aphids (excluding the subfamily CHERMESINAE) collected in Latvia in 1923–26 and includes notes on the biology and synonymy of each species, a list of the food-plants, and keys to the species of *Macrosiphum* and *Aphis*. *Aphis linguae*, sp. n., is described from *Ranunculus lingua*. The male and oviparous female of *Liosomaphis* (*Siphocoryne*) *berberidis*, Kalt., the oviparous females of *Aphis sedi*, Kalt., and *Phorodon humuli*, Schr., and the male and oviparous female of *Myzocallis* (*Pterocallis*) *platani*, Kalt., all hitherto unknown, are described.

[Yaroslavtzev (G. M.).] **Ярославцев (Г. М.). Insect Pests in 1927.** [*In Russian.*]—*Zapadn. Obl. S.-Kh. Op. Stantz.*, no. 29 (Ent. Otd. no. 1), 31 pp., 19 refs. Leningrad, 1928.

This is a report on observations on the pests that infested grain and vegetable crops in the Smolensk Government in 1926–27. Elaterid larvae were the most important pests of clover and winter crops, the damage amounting to about 40 per cent. in some places and to nearly 100 per cent. on potatoes. In 1927 the adults of *Limonius aeruginosus*, Ol., were on the wing in the second half of May. *Agriotes lineatus*, L., *A. obscurus*, L., and *A. sputator*, L., occurred in June, together with *Brachylacon murinus*, L., *Athous haemorrhoidalis*, F., and *A. niger*, L. Larvae of the genus *Sitona* infested the roots of clover, and though they do little damage, the weevils migrate in spring to peas and other pulse crops.

Meromyza nigriventris, Macq., attacked winter rye in June and the ears and stems of winter wheat in June–July. The larvae of *Hylemyia coarctata*, Fall., and *Opomyza florum*, L., which hatched from eggs that hibernated in the soil, infested the spring shoots of winter cereals, wheat suffering more than rye, as the latter was more advanced. The chief pests of winter crops were *Oscinella frit*, L., and *O. pusilla*, Mg., the early sowings being the most heavily infested and the autumn ones being attacked only when the weather was very warm. Winter crops were also damaged by *Mayetiola destructor*, Say, which only attacked spring crops to a slight extent. *Chlorops taeniopus*, Mg., attacked the stems of winter wheat and also damaged spring wheat and barley. *Limothrips denticornis*, Hal., *Haplothrips aculeatus*, F., and *Amaurosoma flavipes*, Fall., attacked winter rye in June; the larvae of the latter pest also damaged timothy grass. Winter wheat was attacked in June and July by *Aphis* (*Sitobion*) *avenae*, F., *Trachea basilinea*, F., *Contarinia tritici*, Kby., and *Sitodiplosis mosellana*, Géh. *O. frit* and *O. pusilla* caused considerable damage to spring barley, wheat and oats. During hibernation, 5 per cent., and during the summer, 21 per cent., of the pupae were destroyed by parasites, the most important being *Trichomalus cristatus*, Först., and the Cynipid, *Eucoila* (*Rhoptromeris*) *wildhalmi*, Kurd. The damage to spring cereals by *Chaetocnema aridula*, Gyll., and *C. hortensis*, Geoffr., was insignificant. The larvae of *Meromyza nigriventris* infested 10–12 per cent. of the stems early in the spring. Spring wheat and barley were also slightly infested by *Phyllotreta vittula*, Redtb., *Hydrellia griseola*, Fall., and *Aphis* (*Siphonaphis*) *padi*, L. Detailed notes are given on the seasonal history of the frit flies, *M. nigriventris*, *Chlorops taeniopus*, *Elachyptera cornuta*, Fall., and *Lasiosina cinctipes*, Mg., and on the damage done by the last two pests to barley and wheat. The larvae of *M. nigriventris*, damaging the ears of winter wheat, were heavily parasitised by *Coelinius viduus*, Hal., and to a less degree by *Stenomalus micans*, Ol.

The most important flea-beetles on vegetable crops were *Phyllotreta undulata*, Kutsch., *P. atra*, F., *P. vittata*, F., and *P. nemorum*, L., which attacked turnips and cabbages, and *P. armoraciae*, Koch, which occurred only on horse-radish. The beetles appeared by the end of May and were abundant towards the end of June and beginning of July, when tobacco dusts had to be applied. *Meligethes aeneus*, F., and *M. viridescens*, F., caused considerable damage to the flowers and buds of turnips grown for seed. The seedlings were attacked by

Eurydema oleraceum, L., *Ceuthorrhynchus quadridens*, Panz., and *C. rapae*, Gyll. *Pieris brassicae*, L., *P. rapae*, L., and *Brevicoryne brassicae*, L., caused considerable damage to cabbage. Many of the pupae of *P. brassicae* were parasitised in the autumn by *Apanteles glomeratus*, L. *Aphthona euphorbiae*, Schr., and *Longitarsus parvulus*, Payk., caused slight injury to flax, the second generation feeding on the stems and seed pods. *Sitona crinita*, Hbst., caused serious damage to young vetch plants, while *S. lineata*, L., occurred chiefly on shoots of peas. Both these weevils infested clover, which was also attacked by *S. sulcifrons*, Thunb., *S. flavescens*, Marsh., *Apion aestivum*, Germ., *A. flavipes*, Payk., *A. assimile*, Kby., *A. virens*, Hbst., and *Hypera* (*Phytonomus*) *nigrirostris*, F.

[Vorontzovskiĭ (P. A.).] **Воронцовский (Л. А.). Material for the Study of the Egg-pods of Acrididae.** [*In Russian.*]—*Trud. Obshch. Izuchen. Kazakst.*, vii, pt. 1, reprint 8 pp., 3 figs. Kzuil-Orda, 1926.

This paper contains an attempt to classify the egg-pods of Acrididae into different types, and descriptions are given of those of *Stenobothrus fischeri*, Ev., *S. nigromaculatus*, H.-S., *Dociostaurus kraussi*, Ingen., *D. albicornis*, Ev., *D. brevicollis*, Ev., *Arcyptera microptera*, Pall. (*flavicosta*, Fisch.), *Ramburiella* (*Arcyptera*) *turcomana*, F.W. (*truchmana*, F.W.), *Oedaleus decorus*, Germ. (*nigrofasciatus*, DeG.), *Oedipoda coerulescens*, L., and *Tmethis muricatus*, Pall.

[Vorontzovskiĭ (P. A.).] **Воронцовский (П. А.). Material for the Study of the Egg-pods of Acrididae. II.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 319–329, 1 fig., 9 refs. Leningrad, November 1928.

This is a continuation of the preceding paper.

Attempts to obtain the egg-pods of Acrididae in cages often fail because movement and, especially, flight are necessary for the maturation of the eggs. The cages must be large enough, and the insects should be as little disturbed as possible. If the conditions of the soils, etc., in the cage approach those in nature, the egg-pods obtained do not differ from normal ones.

The egg-pods of the following species are described: *Chorthippus pulvinatus*, F.W., *C. albomarginatus*, DeG., *C. parallelus*, Zett., *C.* (*Stauroderus*) *macrocerus*, F.W., *C.* (*S.*) *vagans*, Ev., *C.* (*S.*) *biguttulus* L., *C.* (*S.*) *bicolor*, L., *C.* (*S.*) *morio*, Charp., *Aiolopus* (*Epacromia*) *tergestinus*, Charp., *Gomphocerus sibiricus*, L., *Arcyptera fusca*, Pall., *Celes variabilis*, Pall., and *Podisma pedestris*, L.

[Kuznetzov (V.).] **Кузнецов (В.). Two injurious Leafhoppers of the Genus** *Erythroneura*, **Fitch (Homoptera).** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 315–317. Leningrad, November 1928.

The Jassid, *Erythroneura heptapotamica*, sp. n., is described from Semiryechensk (Central Asia), where it occurred in large numbers on hops in the summer of 1927, causing the leaves to wither and die. *E. parvula*, Boh., an important pest of vines in Azerbaijan, is also described, and its distribution in Europe is indicated.

[Konakov (N. N.) & Onisimova (Z. G.).] **Конаков (Н.Н.) и Онисимова (З.Г.). *Notodonta anceps*, Goeze, a new Pest of Oak in the Voronezh Government.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 331–334, 6 figs. Leningrad, November 1928.

A very heavy infestation of *Notodonta anceps*, Goeze (*trepida*, Esp.) occurred in the oak forests of the Voronezh Government in the summer of 1927. The existing literature on this moth is very briefly reviewed. Trees over 25 years old were not attacked, and the infestation was wiped out by an epidemic disease in June–July, which is fully described. *Calosoma sycophanta*, L., was predacious on the larvae.

[Bryantzev (B.).] **Брянцев (Б.). Some Observations on the Migration of the Larvae of the Gipsy Moth from Forests to Fields and Orchards in the Kursk Government in 1927.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 370–371. Leningrad, November 1928.

The gipsy moth [*Porthetria dispar*, L.] caused considerable damage to forest trees, chiefly oaks, in the southern part of the Kursk Government in 1927. By 17th June the larvae were full-grown, and about 20 per cent. of them pupated. About 50 per cent. of the larvae and pupae were killed by Tachinid parasites and bacterial diseases. Oaks over 10–15 years old were only slightly infested; the larvae also occurred on elm, birch and ash. After defoliating the trees, the larvae migrated to adjoining cultivated fields, where they attacked clover and wheat, though oats and rye remained untouched. They also migrated to orchards adjoining the infested forest when these were not separated by fallow land.

[Noskov (I.).] **Носков (И.). Some Observations on *Schistocerca gregaria*, Forsk.** [*In Russian.*]—*Défense des Plantes*, v. no. 3–4, pp. 371–372. Leningrad, November 1928.

Swarms of *Schistocerca gregaria*, Forsk., migrated from India into Persia in 1927, and an enormous area in the east, stretching from the sea almost to the northern frontier, was infested by eggs, while stray swarms and individuals have been observed even as far north as Transcaspia. The density of infestation was very great, up to 600–700 egg-pods to 2½ sq. ft. In the northern districts the larvae hatched about the middle of May and reached the adult stage early in July. The larvae and adults damaged a great variety of cultivated crops and trees, including cereals, cotton, beet, clover, apricots and almond. On vines the stalks of bunches of grapes are often damaged so that the bunch falls to the ground. Poison baits proved to be very effective against both larvae and adults.

[Azov (Z.).] **Азов (З.). Experiments for the Control of Flea-beetles on Cabbage Seedlings by Means of Calcium Arsenite and other Insecticides.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 372–374. Leningrad, November 1928.

Experiments were carried out in May and June 1927 in the Vologda Government for the control of *Phyllotreta undulata*, Kutsch., and *P. nemorum*, L., on cabbage seedlings.

The following insecticides were used: calcium arsenite alone and mixed with slaked lime or wood ashes; tobacco dust; and Paris green mixed with wood ashes as a dust, or with water, ashes and soap as a spray. The day following the application, the pure calcium arsenite showed the best results, the Paris green spray being the least effective. By the third day the effect of all the insecticides was equal, nearly all the flea-beetles being killed.

[Maslovskiĭ (N.).] **Масловский (Н.). Two new Forest Pests of the Transbaikal Region.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 376–377. Leningrad, November 1928.

In the summer of 1926 an Acridid, *Eirenephilus debilis*, Ikonn., seriously damaged the leaves of bird-cherry [*Prunus padus*] and crab apples in part of Transbaikalia. The larvae of *Vanessa* (*Polygonia*) *l-album*, Esp., occurred in numbers in birch forests, entirely defoliating the trees. About 75 per cent. of the larvae and 25 per cent. of the pupae were destroyed by bacterial diseases.

[Stark (V. N.).] **Старк (В.Н.). The Development of** *Blastophagus minor*, **Hart., in Stumps of old Pines: Pine Bark-beetles on Fir:** *Pachyta lamed*, **Linn., as Pest of the Needles of Pines and Firs.** [*In Russian.*]—*Défense des Plantes*, v, no. 3–4, pp. 377–378. Leningrad, November 1928.

A short account is given of observations on *Myelophilus* (*Blastophagus*) *minor*, Htg., which appeared in 1926 and 1927 in the Bryansk Government on the lower unbarked parts of the stumps of old pines felled in the preceding winters. The stumps should be barked early in the spring, as thorough barking is impossible in winter owing to the severe frost.

The following bark-beetles have been recorded from forests in the Kola peninsula: *Ips bidentatus*, Hbst. (*Pityogenes bidens*, F.), on standing dying firs and on the branches of those on the ground; *Ips sexdentatus*, Boern., in small numbers on old dying fallen firs; and *I. acuminatus*, Gyll., and *Carphoborus cholodkovskyi*, Spess., which occurred only on the southern sides of the mountains on firs.

In July 1928 the Longicorn, *Pachyta lamed*, L., attacked the needles of pines and firs, chiefly of older trees, in the Kola peninsula. The beetles were especially active on sunny days.

[Il'inskiĭ (A.).] **Іллінський (А.).** *Dendrolimus pini*, **L., its Life-history and Control in Forests.** [*In Ukrainian.*]—8vo, 40 pp., 30 figs., 15 refs. Kiev, Vseukr. Tzentr. Upravl. Lisami [Ukrain. Cent. Admin. Forests], 1928. Price 1 krb.

Dendrolimus pini, L., has been unusually abundant in the Ukraine since 1919, causing serious damage in pine forests.

In the Kharkov Government the moths first appear in June, the mass flight occurring in the middle of July and ending in August. Each female lays from 200 to 330 eggs, which are deposited in batches of 20–150 on pine needles, thin twigs, the bark of the trees and, when the moths are specially abundant, on grass, rubbish, etc. They hatch in from 2 to 5 weeks, depending on weather conditions, the larvae appearing in the second half of July or during the first half of August

and feeding on the needles. In the second half of October the larvae drop to the ground to hibernate in the rubbish under the tree, within the radius of the crown. When the weather in autumn is very warm, some of the larvae resume their activity, but most of them remain dormant till the spring. They emerge from hibernation over a period of about two weeks in March or April, and pupate in June or early July. The pupal stage lasts about 3 weeks.

After having entirely defoliated one part of the forest, the larvae migrate to adjoining areas until they reach the outskirts of the forest and their activity is gradually brought to an end by bacterial diseases, parasites, and predators. As the female moths and the larvae travel very slowly, their spread can be controlled by digging trenches and felling parts of the forests. The means by which the existence and extent of an infestation can be determined are discussed in detail. In an organised campaign carried out from the autumn of 1926 to the spring of 1928, the application of adhesive bands was found to be one of the best control measures; the methods of doing this are fully described. The bands should be applied in early spring after the inspection of the forests and preliminary determination of the extent of the infestation. Other measures recommended include digging trenches, with holes about one foot deep at the bottom, into which the larvae fall, and hand-picking the eggs and pupae from young trees. The planting of deciduous trees amongst the pines would encourage the breeding of parasites and bacterial diseases and check the spread of *D. pini*.

[Predtechenskiĭ (S.A.).] **Предтеченский (С.А.).** *Locusta migratoria*, **L., in Central Russia.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 113–199, 4 figs., 90 refs. Leningrad, 1928. (With a Summary in English.)

Locusta migratoria, L., is distributed throughout Central European Russia, and outbreaks occur periodically, *e.g.*, in 1890–93, 1897–1899 and 1920–23. An increase in the numbers of the locusts is usually gradual, and it is only in the second or third year of each period that they appear in masses. These mass outbreaks have usually been thought to be due to invasions of the area by swarms arriving from the south, but the author regards this locust as a normal member of the fauna of Central Russia, there being at least three different areas that may be considered particularly favourable to it and as serving as its permanent breeding areas. These are situated in the valleys of the rivers Desna, Oka and Voronezh. These breeding grounds are quite independent of those in the semi-desert zone of South Russia and are separated from them by a wide steppe zone where ecological conditions are unsuitable to it. The appearance of the locust in Central Russia must have occurred during the postglacial xerothermic epoch, when southern forms spread northwards; later, a damp period followed and forests encroached on Central Russia from the north and compelled the locusts to concentrate in a few restricted places with suitable ecological conditions. The present breeding grounds are due to the action of man, who destroyed forests and created open spaces with conditions of soil and humidity favourable to the locust.

Increases in the numbers of the locusts in Central Russia are connected with a succession of exceptionally dry and hot summers, which favour their rapid development and abundant reproduction. The northern

limit of their mass appearance seems to coincide roughly with the summer isotherm 13·6° C. [56·5° F.]. The ecological distribution of the locust depends very closely on the microclimatic conditions of its habitats, the insect being concentrated mainly on raised watersheds with sandy soil and scanty vegetation, because these are the warmest and driest habitats in the area. During the outbreaks, locusts spread more widely and occupy various habitats, some of them being quite unfavourable to the species ; consequently these emigrations from the permanent breeding grounds acquire the significance of an indirect regulator of outbreaks.

The natural enemies of locusts observed in Central Russia are not numerous and have no real importance in their control. The eggs are attacked by *Anastoechus nitidulus*, F., *Epicauta erythrocephala*, Pall., *Scelio uvarovi*, Ogl., and larvae of *Athous niger*, L., and Carabids. *Blaesoxipha lineata*, Fall., and *Blaesoxiphella brevicornis*, Villn., are parasites of the larvae and adults.

The economic importance of locusts during outbreaks in Central Russia is very great, particularly because they coincide with, or follow, exceptionally dry and hot years when the crops are very poor. Winter rye is particularly subject to attack, and spring oats and millet also suffer. The individual development of the locusts is governed by the meteorological conditions of the year ; thus, adults were observed in 1921 from 18th June to 30th September, in 1922 between 10th July and 3rd October, and in 1923 between 3rd July and 19th October. Males reach sexual maturity 7–17 days after the last moult ; females take 30–35 days to mature. If the average temperature is below 17° C. [62·6° F.] and is accompanied by high relative humidity (80 per cent.), the locusts cannot become sexually mature.

The individuals of this species from Central Russia differ from those of the semi-desert and desert zone of South Russia in size, colour and proportions of parts of the body, being on the whole a much smaller race. The solitary phase is particularly small when compared with the corresponding one of the southern race and is presumably identical with the true *danica* of Linnaeus. The author suggests, therefore, that this more northern race of *L. migratoria* should be called subsp. *danica*, and its phases, as well as the phases of the true southern *migratoria*, should bear the names proposed by Plotnikov, *i.e.*, ph. *accumulata* and *dispersa*, respectively ; the latter name he restricts to individuals originating from scattered swarms, while for those living as solitary insects a new name, phase *solitaria*, is proposed.*

[Меŭер (N. F.]. **Мейер (Н. Ф.). On the Biology of Parasites of *Feltia segetum*, Schiff.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 201–218, 1 pl., 13 figs., 27 refs. Leningrad, 1928. (With a Summary in German.)

Outbreaks of *Euxoa* (*Feltia*) *segetum*, Schiff., usually last several years. Among the factors that reduce the numbers of the larvae are various Ichneumonid and Braconid parasites ; a list of those recorded in Russia is given. Laboratory experiments were carried out with three of the Ichneumonids, *Banchus falcatorius*, F., *Anomalon cerinops*, Grav., and *Amblyteles vadatorius*, Ill., all stages of which are described in detail, in order to determine their economic significance and the

* It would appear difficult to accept these changes in nomenclature since the forms to which they refer are very inadequately defined.—Ed.

possibility of using them for the control of this moth. The habits and distribution of these parasites, which are very common in Russia, are discussed. *Banchus* and *Anomalon* occur chiefly in the central part of the country, and *Amblyteles* in the south.

B. falcatorius is also a parasite of the larvae of *Feltia exclamationis*, L. A female may lay as many as 400 eggs, only one being deposited in each host larva. It chiefly attacks larvae in the first and second instars. The parasite larvae hatch in about 3 days and are mature about 25 days later, after which they spin cocoons, in which they hibernate, pupating and emerging as adults in the following spring. Under laboratory conditions with a raised temperature two generations of *B. falcatorius* were obtained in a year, and this may perhaps occur in nature in South Russia, where *E. segetum* has two generations.

Anomalon cerinops, which attacks third and fourth instar larvae of *E. segetum*, has also been recorded from a number of other Lepidoptera, a list of which is given. Dissected females contained a maximum of 672 eggs. The eggs are deposited singly into the mouth of the host larva and hatch in 8 days. The larval stage lasts over 25 days, the first instar larvae enter a resting stage and only begin to feed when the host pupates. In north-western Russia *A. cerinops* has two generations a year, the adults usually occurring in the middle of June and again at the end of August. The parasite hibernates as a full-grown larva in the pupa of the host, or as a first-stage larva in cases when the host itself hibernates in the larval stage. *B. falcatorius* and *A. cerinops* can reproduce parthenogenetically, and in this case only males result.

Amblyteles vadatorius parasitises *Heliothis* (*Chloridea*) *dipsacea*, L., *Euxoa segetum*, *F. exclamationis*, and *Agrotis* (*Triphaena*) *pronuba*, L., chiefly attacking the full-grown larvae. Under laboratory conditions only 1 or 2 larvae were attacked in a day, which shows that the period of oviposition is very prolonged. In captivity the parasites lived about 3 months. The female deposits one egg in the body of each host, and the total number of eggs does not exceed 140. The egg hatches in 2 days; the larva, which develops partly in the larva and partly in the pupa of the host, is full-grown in about 23 days and pupates in the host pupa. In South Russia *A. vadatorius* produces two generations a year, the life-cycle from egg to adult lasting about 42 days. Hibernation occurs in the adult stage under moss or in the bark of old tree trunks.

These three parasites could be used against *E. segetum* and other pests by breeding them in the laboratory and liberating them in infested places at the beginning of an outbreak.

[Vodinskaya (K. I.).] **Водинская (К. И.). On the Biology and Ecology of** *Hylemyia brassicae*, **Bché., and** *H. floralis*, **Fall.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 229–249, 11 figs., 27 refs. Leningrad, 1928. (With a Summary in German.)

Previous observations on Anthomyiids attacking cabbage and work carried out in Russia and elsewhere during the past century are briefly reviewed, and a detailed account is given of laboratory experiments made near Leningrad with *Phorbia* (*Hylemyia*) *brassicae*, Bch., and *P.* (*H.*) *floralis*, Fall., these two species being the most important of those attacking this plant in Russia. All the stages are fully described. Both species hibernate as pupae. In the Leningrad Government *P. brassicae* has two generations a year, the flies being on the wing

between 25th April and 25th May and again from 5th to 30th July; the emergence of the adults depends entirely on the temperature of the soil. *P. floralis* has only one generation a year in nature, though a second has been obtained in the laboratory at a temperature of 17–20° C. [62·6–68° F.]. The adult flies are on the wing in late June or early July.

The habits of the adults of both species are alike. Dryness of the air (humidity below 35 per cent.) and a temperature of 17° C. [62·6° F.] are fatal to them. The often occur on flowering trees. They do not attain sexual maturity for a week or more after emergence and usually live 2–4 weeks; in insectaries individual females lived for over 3 months. *P. brassicae* scatters its eggs on the stems of cabbage seedlings and on the ground close to the stems; also on leaves of root-crops, of which radishes are preferred, or on cruciferous weeds. The maximum number of eggs laid by an individual female in the insectary was 149. The favourable temperature for oviposition is between 8 and 26° C. [46·4–78·8° F.]. The number of eggs laid by *P. floralis* in the insectary did not exceed 297. They are deposited in batches of 40 on the ground at the base of the stems of cruciferous plants.

The eggs of both species hatch in 6–8 days. They are killed by a temperature of 35° C. [95° F.] and cannot withstand dry conditions. The larvae of *P. brassicae* mature in 21–25 days; they eat into the green part of the root of the food-plant immediately under the surface of the soil, and if numerous, penetrate into the centre of the root. They pupate in cocoons in the soil at a depth of 1½–5 ins.; or in the plant itself if the soil is dry. In 12–18 days adults emerge from a few of the cocoons; the majority, however, hibernate. The second generation is not numerous and is of no economic importance in Russia. The duration of the pupal stage depends entirely on the temperature. The pupae are killed at temperatures over 25° C. [77° F.], and at 6° C. [42·8° F.] they enter a diapause. Lack of humidity does not reduce the period of pupation, but kills a certain percentage. The pupal habits of *P. floralis* are very similar, but the pupae occur rather deeper in the soil.

The larvae of both species occur together, but in the spring the chief damage is done by the first generation of *P. brassicae*, which destroys 80 per cent. of the plants, while in the summer *P. floralis* damages 100 per cent. Meteorological factors and natural enemies somewhat control the damage caused by these flies. *Mydaea duplicata*, Mg., destroys 70 per cent. of the adults of both species. The pupae are attacked by the Staphylinid, *Aleochara bilineata*, Gyll., the Ichneumonids, *Phygadeuon fumator*, Grav., and *Stilpnus gagates*, Grav., and the fungus, *Spicaria aphodii*. The damage caused by *P. brassicae* can be reduced by early planting of cabbage seedlings, which should be completed by the end of April or beginning of May, before the appearance of the fly. To control *P. floralis* the resistance of the plants should be assisted by good cultivation.

[Kreĭter (E. A.).] **Крейтер (E.A.). Dipterous Larvae occurring on Graminaceous Plants in the Leningrad Government.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 251–264, 15 figs., 1 ref. Leningrad, 1928. (With a Summary in German.)

As many Dipterous pests of graminaceous plants may be confused owing to the similarity of their attacks, a special study was made of

those occurring in the Leningrad Government, and a key is given for their determination according to the damage done. The morphology and biology of the more common species in North Russia are briefly described, and a key to the larvae and pupae is given, the species dealt with being *Chlorops taeniopus*, Mg., *Meromyza saltatrix*, Mg., *Mayetiola destructor*, Say, *Cetema elongata*, Mg., *Hydrellia griseola*, Fall., *Amaurosoma flavipes*, Fall., *Balioptera tripunctata*, F., *Opomyza florum*, Fall., *Oscinella frit*, L., *O. albipalpis*, Mg., *Lasiosina cinctipes*, Mg., *Notonaulax trilineata*, Mg., *Elachiptera cornuta*, Fall., and *Hylemyia coarctata*, Fall.

[Aristov (M. T.).] **Аристов (М.Т.). On the Hibernation of *Anthonomus pomorum*, L.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 265–271, 1 fig., 16 refs. Leningrad, 1928. (With a Summary in German.)

Studies were carried out in 1926–27 in the Voronezh Government in order to find appropriate measures for the control of *Anthonomus pomorum*, L., during hibernation. The literature on the subject is very briefly reviewed. Experiments in June 1926 showed that the weevils migrate from the crown of the tree downwards to the bark of the trunk. During the summer they occur in cracks on the shady side of the trunk and larger branches. They hibernate in the bark, but nearer to the bottom of the trunk. A few hibernating individuals were found in the soil immediately under and around the trees, but only in dry places. Medium temperature, good aeration, absence of light and moderate humidity are favourable to the hibernation of *A. pomorum*. The absence of these conditions causes the migration of the weevil to adjoining forests, etc., whence it returns to the orchards in the spring. Periodical watering of the soil round the apple trees and cleaning the bark in order to make it smooth are recommended for the control of *A. pomorum*.

[Skorikov (A. S.).] **Скориков (А.С.). The Production of Red Clover Seed and Pollinators. A methodical Study.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 273–280. Leningrad, 1928. (With a Summary in German.)

This is an account of experiments carried out in clover fields in Russia since 1922 in order to determine the relation between the pollen carriers, such as bees, and seed production. The methods of estimating seed production in relation to pollinators should be improved, so that an accurate estimate of the required number of hives to a given area of clover may be made.

[Shtakel'berg (A. A.).] **Штакельберг (А. А.). On the Synonymy of the Melon-fly *Myiopardalis pardalina*, Big.=*caucasica*, Zaitz.** [*In Russian.*]—*Izv. Otd. prikl. Ent.*, iii, no. 2, p. 281. Leningrad, 1928. (With a Summary in German.)

As a result of the study of individuals of this fruit-fly from India and the Caucasus, it is found that *Myiopardalis* (*Carpomyia*) *caucasica*, Zaitz., is a synonym of *M. pardalina*, Big.

[Pisnyachevskiĭ (A. A.).] **Писнячевский (А. А.). The Programme and Preliminary Results of the Work carried out by the Field Experimental Laboratory of the Nizhni-Novgorod Station for the Protection of Plants at the Simbileisk Agricultural Experimental Station during 1924 and 1925. Part i.** [*In Russian.*] —*Trud. Simbil. Raionn. s.-kh. op. St.*, i, pp. 183–232. (Abstract in *Izv. Otd. prikl. Ent.*, iii, no. 2, pp. 317–319. Leningrad, 1928.)

This is the first account of the work of this field laboratory. Considerable damage was done to cereals during the spring and summer of 1924 and 1925, late sowings of spring crops suffering the most. The frit fly [*Oscinella frit*, L.], the straw fly [*Chlorops taeniopus*, Mg.], the Hessian fly [*Mayetiola destructor*, Say], *Hylemyia coarctata*, Fall., and *Opomyza florum*, F., were the most destructive pests. The stems of winter crops were attacked in 1924 by *Prolasioptera* (*Lasioptera*) *cerealis*, Lind., and in the spring of 1925 by large numbers of frit flies. Spring oats suffered least and were only attacked by frit flies. The relation of the time of attack by various pests to the ultimate crop is described in detail. Infestation of spring wheat and oats by *O. frit* at any time greatly reduces the crop. The crop of spring wheat was also reduced by *C. taeniopus* attacking late sowings, and by *M. destructor* in the summer, especially in the case of the second and third sowings.

[Korab (Ĭ.).] **Кораб (Й.). On the Sterility of the first Generation of** *Loxostege sticticalis*, **L., in Belaya-Cerkov District and an Attempt to explain it.** [*In Ukrainian.*]—*Trud. Bilotzerk. Selektz. Sta.* [*Bull. Belaya-Cerkov Plant-Breed. Sta.*], ii, pt. 5, pp. 127–132, 3 figs., 4 refs. Belaya-Cerkov, 1927.

The occurrence of symbiotic organisms in insects is discussed, and it is pointed out that when certain changes occur in the host, such organisms may become injurious parasites. Examples of this are *Coccobacillus acridiorum* in locusts, and the fungus, *Isaria*, in *Cossus cossus*, L. (*ligniperda*, F.). Sterility, which sometimes occurs in the second generation of *Loxostege sticticalis*, L., has been explained as being due to a fungus, and the existing literature on the subject is briefly reviewed. In 1926 an extensive outbreak of *L. sticticalis* occurred in the Ukraine, causing enormous damage to beet. The first adults appeared on 5th June. In females dissected in the first half of June, the reproductive organs were quite normal, but those examined in the middle and end of the month contained an abnormally small number of eggs. As a result very few were laid in the field, owing to the sterility of the females of this (first) generation. Microscopic examination showed that a fungus (? *Isaria* sp.) infested the ovaries, 85 per cent. of the females being infested at the end of June. Infested moths were sluggish and easily caught by hand. *L. sticticalis* suffered from the same fungus throughout the Ukraine at the same time, and as a result hardly any moths occurred in 1927. Rainy weather, strong winds and low temperature were also unfavourable to oviposition and the breeding of the insect in 1926.

[Il'inskiĭ (A.).] **Іллінськнй (A.). Laws governing the Increase of *Blastophagus minor*, Hartig, and theoretical Foundations of its Control in Forests. (Preliminary Report.)** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 33–94, 3 graphs, 2 refs. Kiev, 1928. (With a Summary in German.)

This is a detailed account of experiments carried out near Kiev in 1925 and 1926 in continuation of the work begun by Z. S. Golovyanko [*R.A.E.*, A, xiv, 208], with a view to gathering more material for elaborating the mathematical formulae worked out by the latter, and determining the laws that govern the increase of *Myelophilus* (*Blastophagus*) *minor*, Htg., in pine forests, in relation to practical control. The work of Golovyanko and his theories are very fully reviewed. The increase of *M. minor* is regulated by the overcrowding of the beetles on individual trees, which results in a decrease of their energy for propagation and causes a number of them to die.

The chief point in the control of *M. minor* lies in the decrease of the number of infested standing trees; timely felling and barking of such trees is, therefore, recommended, and this should be done from year to year until the beetle is exterminated. This measure is preferable to the use of trap logs, which are only recommended when it is necessary to attract the beetles attacking individual trees in slightly infested adjoining areas; for this purpose, standing trees that are already weakened through their attacks should be used. The logs should be laid in the winter within the radius of the crown of the infested standing trees; all the branches should be left on the trap log. The number of the logs required can be determined by a formula based on the number of beetles infesting the tree and the surface area of the trunk.

[Greze (N.).] **Грезе (M.). On the Biology of the Pine Weevil (*Hylobius abietis*, L.).** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 95–118, 6 graphs, 11 refs. Kiev, 1928. (With a Summary in German.)

This is a detailed record of experiments carried out in the Kiev Government from 1925 to 1927 with a view to obtaining biological data and to determining the influence of climatic conditions on the development of *Hylobius abietis*, L. (pine weevil). The existing literature on the subject is reviewed. The weevils used in these experiments were bred in trap holes about 2 feet deep, containing pine stakes covered with earth, arranged according to Grohmann's method [*R.A.E.*, A, ii, 325–328]. Between 30th April and 20th June adults were dissected, and it was found that the males attain sexual maturity much earlier than the females, and that though individual females could lay eggs by the end of April, the majority had to feed till late in the autumn before becoming sexually mature. As a result of this, the period of oviposition is very extended, though the bulk of it occurs from the end of May till the end of June.

In the trap holes in shady places, the first larvae were noticed in 1925 on 17th May and the majority on 1st June. On 30th October all the larvae were full grown and hibernating in cocoons in cracks and under the bark of the pines. Hibernation lasts till May. The first pupae were noticed on 1st June, but most of them were found in the middle of July. The first young weevils appeared in the beginning of July, the majority of them at the end of August. The author does not agree with

the view of Escherich [*R.A.E.*, A, ix, 156] that some of the larvae enter a diapause as early as July or August owing to temperature conditions being unfavourable for pupation, as he found that pupation occurred the following year at lower temperatures than existed when the diapause began. He therefore suggests that this retardation in development is due to some internal factor, and that, owing to the diapause, all larvae are in the same state of development at the beginning of the winter. The further development of *H. abietis* is largely dependent on temperature conditions. In the trap holes, the pupae and adults appeared earlier in the upper parts, whereas the development of the individuals at the bottom, where the temperature was lower, took much longer.

The whole life-cycle of *H. abietis* requires 11–16 months. Weevils that emerge late in the summer begin to oviposit only in the spring of the following year. In the Ukraine *H. abietis* develops either with or without the larval diapause, though the former is more usual. The percentage of the early developed weevils depends on temperature conditions.

[Greze (N.).] **Грезе (M.). Trap Trenches as a Means of Controlling** *Hylobius abietis*, **L.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 119–135, 4 graphs, 5 refs. Kiev, 1928. (With a Summary in German.)

This is a detailed account of observations carried out between 30th April and 20th October 1926, on trenches dug in a forest near Kiev to trap *Hylobius abietis*, L. (pine weevil) for experimental purposes. The existing literature on the utility of such trenches as a control measure is briefly discussed, and the method of arranging the trenches with pits 11 yards apart is described [*cf. R.A.E.*, A, iv, 499]. Besides the larvae of *H. abietis* and various other pests, a number of small insectivorous animals and beneficial insects were caught. A full account of the number and species of these is given. In the year under review *H. abietis* was not abundant in the inspected region, and only at the end of April and in May were large numbers of the weevils trapped. During the summer and autumn trap trenches are of no practical use, as at that time the insects caught are either of no economic importance as pests, or are beneficial.

[Il'inskiĭ (A.) & Greze (N.).] **Іллінський (A.) та Грезе (M.). The Method and Results of Inspecting Forests infested by** *Dendrolimus pini*, **L.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 141–163, 3 figs., 4 pls., 6 refs. Kiev, 1928. (With a Summary in German.)

This is a detailed account of inspections carried out in part of the Ukraine in the winter of 1926 and the spring of 1927 to determine the degree of infestation of pine forests by *Dendrolimus pini*, L. The previous method of determining the seriousness of infestation by reckoning the number of hibernating larvae within a radius of about a yard from the trunk of the tree was found unsatisfactory, as experiments showed that most of the hibernating larvae occur in the ground within the radius of the crown at a distance of about 3 yards from the trunk. This indicates that the larvae do not come down the trunk of the tree for hibernation, but drop from the branches. Outbreaks

of *D. pini* occur invariably at the same time in large areas, and the necessity of carrying out control measures simultaneously throughout the whole infested area of the forest is emphasised. Adhesive bands were used where on the average not less than 50 larvae occurred over an area of about 2½ sq. yds., but it would be better to apply them even when only 30 to 40 larvae occur on this area. Collecting the larvae from trees not older than 20 years is suggested. In the course of 3 years, adhesive bands were applied to trees in over 12,500 acres of forest, with satisfactory results.

[Rudnev (D.).] **Руднев (Д.). *Cerambyx cerdo*, L., in the Forests of the Ukraine and its Control.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 165–206, 1 diagr., 9 pls., 33 refs. Kiev, 1928. (With a Summary in German.)

In view of the serious damage done to oak forests in the Ukraine by *Cerambyx cerdo*, L., special observations were carried out in 1927–28. The beetles are on the wing from the end of May until August, the mass flight occurring in June. The life of an adult lasts 1–2½ months. Various authors state that during the day the beetles hide in the galleries they make in the trees and fly only during the night, but observations showed that in the Ukraine they usually fly during the whole day, sometimes covering long distances.

In 1927 oviposition began on 30th May, the eggs being laid in the cracks of the bark and on stumps, especially when the trees had been recently felled. Only one egg is deposited at a time, a female laying from 60 to 100 in all. Very often oviposition occurs also in galleries made in the tree by *Xyleborus*. For flight and oviposition *C. cerdo* prefers sunny places, particularly the south and west outskirts of old strips of forest. In the Ukraine its life-cycle lasts three years. The eggs hatch in 12–14 days. The first larvae were found in the middle of July ; they feed on the dead bark and later on the bast and the wood of the tree. In the second year they are full-grown and cause most damage. In the middle of June they begin to spin cocoons for pupation. The first adults were found on 5th August ; they oviposit in the following year. *C. cerdo* only attacks quite healthy and old oaks and stumps. Trap logs are therefore useless. The lower part of the trunk is attacked first, infestation gradually spreading to the upper parts of the trunk and to thick branches. Thicker trees are more severely infested, but infestation is less if the forest is dense. The beetle is favoured by any factor that decreases the shade, such as felling strips in the forest, removing the undergrowth or felling other trees growing among oaks ; forest practices in relation to these factors are discussed.

Only a very few parasites of *C. cerdo* are known. The Encyrtid, *Tyndarichus rudnevi*, Now. [*R.A.E.*, A, xvi, 609] usually only destroys about 5 per cent. of the eggs. About 0·5 per cent. of the larvae are killed by a fungus.

Hand-collection of the beetles in June, at the time of oviposition, is recommended. The felling of trees in the course of the next few years should be concentrated in places where a mass increase of *C. cerdo* has occurred. It is best to fell all trees without leaving any strips or old seed-bearing oaks. When the stumps are not kept for traps, they should be uprooted at the time of felling ; existing stumps should also be uprooted or barked. As the beetle first attacks trees

at the outskirts of the forest and its life-cycle is only completed in three years, it will not have time to spread if these trees are felled. In cases when the outskirts of the forest are to be used as protection for young growth, the regeneration period may be prolonged, but must not exceed the period of the life-cycle of the beetle. The undergrowth should be protected and kept in a healthy state.

[Tz'opkalo (V.).] **Цьопкало (B.). *Zeuzera pyrina*, L., in the Forests of the Southern Steppes.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 207–230, 2 graphs, 3 pls., 33 refs. Kiev, 1928. (With a Summary in German.)

Zeuzera pyrina, L., has lately spread and done considerable damage in planted forests in the steppes of southern Ukraine. Observations on it were carried out in 1926–28. The larvae are general feeders, and a list is given of 61 species of trees on which they may be found; in the Ukraine they chiefly attack ash, though oak, elm, etc., are also infested. The adults occur from the middle of June till the second half of August, males being considerably less numerous than females. The life-cycle extends over two years. Eggs are laid one at a time on the stems and in the folds of young leaves, on buds and on the upper part of young shoots. Under artificial conditions one moth laid as many as 453 eggs in a day. The larvae hatch in about two weeks and at once penetrate into the stem of the leaf, or into the shoot or twig on which the egg was laid. They feed on the soft tissue; the infested twig, etc., soon withers and falls off. The larvae gradually penetrate into the thick branches, where they hibernate until the following April, when they make their way into the trunk of the tree. The galleries made by them cause the tree to wither or weaken it to such an extent that it cannot resist the damage done by bark-beetles and other pests. Simultaneous attacks of *Z. pyrina* and *Cossus* are especially harmful.

Natural enemies observed in the Ukraine, none of which were of much importance, include woodpeckers, *Ichneumon abeillei*, Berth., which parasitises the pupae, and two Chalcids, *Euderus* sp. and *Elasmus* sp., which were found in the larvae. Some of the larvae were attacked by the mite, *Pediculoides ventricosus*, Berl., and some were killed by a muscardine fungus. Observations showed that there exists a direct correlation between the diameter of the trees, the number of ash trees in the plantation and the degree of infestation. The absence of undergrowth is also very favourable to the spread of *Z. pyrina*. As this pest attacks chiefly weak trees, it is essential to plant species that are suited to the climate and soil; pure stands of ash should not be planted. Felling should be done before the trees are 20–25 years old and increase in diameter. A thick undergrowth should be cultivated and protected as it forms unfavourable conditions to the moth and checks its spread.

[Zhikharev (I.).] **Жихарев (I.). Injurious and other Lepidoptera in the Darnitza Experimental Forest.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 231–330, 1 fig., 25 refs. Kiev, 1928. (With a Summary in Russian.)

This is an account of observations on the Lepidoptera in a forest in the Ukraine made from July 1925 till October 1927, 748 species being

recorded. Of the injurious species only *Malacosoma neustria*, L., *Porthetria* (*Lymantria*) *dispar*, L., *Bupalus piniarius*, L., *Rhyacionia* (*Evetria*) *buoliana*, Schiff., and *Euxoa* (*Rhyacia*) *vestigialis*, Rott., which attacks pines, occurred in large numbers in 1925 and 1926.

Experiments with larvae of *Lymantria monacha*, L., under conditions very near to natural ones, showed that outbreaks of this moth only occur if the weather is sufficiently warm, dry and not windy. The larvae cannot survive unless they hatch when young shoots and flower-buds of pine are bursting. The eggs of *L. monacha* are infested by the larvae of *Dermestes erichsoni*, Gnglb., which, together with those of *Attagenus*, also destroy a considerable number of eggs of *Porthetria dispar* in July and August. Most of the larvae of *Bupalus piniarius*, L., occur on isolated pines and on those situated on the outskirts of the forest. Dry weather is very favourable to the increase of this pest. *Rhyacionia buoliana* occurs in small groups and chiefly attacks weak and undeveloped pines. This moth flies only very short distances and breeds for many consecutive years on the same group of trees. Under laboratory conditions it was parasitised by *Pimpla examinator*, F., *P. triangularis*, Verhoeff, and *Orgilus obscurator*, Nees.

[Pilyugina (O.).] **Пилюгина (О.). *Salebria marmorata*, Alph., as a Pest of Yellow Acacia. (Lepidoptera, Pyralidae.)** [*In Russian.*]—8vo, 16 pp., 11 figs., 12 refs. Saratov, Kraev. S.-Kh. Opuitn. Sta. [? 1928].

A detailed description is given of all stages of *Salebria marmorata*, Alph., and the existing literature on this moth is very briefly reviewed. The more important features of its bionomics were described in a previous paper [*R.A.E.*, A, xiv, 29]. In the Saratov Government it usually has only one generation a year, but sometimes a second may appear in August. Under laboratory conditions, the average life of the moths was 8–9 days. The larvae, which only occur on yellow acacia [*Caragana arborescens*], are very active and live in galleries made of leaves spun together.

Sprays recommended include 1 lb. barium chloride to 4 gals. water [not 40 gals. as stated in the previous abstract—*cf. loc. cit.*], and 1 lb. Paris green and 2 lb. lime to 100 gals. water.

[Yakhontov (V. V.).] **Яхонтов (В.В.). The Economic Importance of *Tetranychus telarius*, L.** [*In Russian.*]—*Khlopkovoe Delo*, vii, no. 11–12, pp. 895–898, 1 ref. Moscow, 1928.

The damage done by *Tetranychus telarius*, L., to cotton in the Bokhara region depends on various conditions, such as the time of the infestation of the plant, the composition and the tillage of the soil, the variety of the cotton, the time of its sowing and irrigation. Observations were made in 1927 with a view to determining the approximate loss of crop caused by the mite. The methods used are described in detail. Laboratory experiments showed that the germinating power of the seeds from healthy and infested bolls was similar, but that the plants appeared in 2–7 days in the case of the former and not for 5–12 days in the case of the latter. This is of great importance for the northern regions, where the amount of warmth available to produce the sprouting of cotton is limited. *T. telarius* retards the development of infested plants, parts of which wither and fall off ; the bolls diminish

in weight and the fibres are shortened. It was impossible to determine exactly the economic injury done to the fibre ; but observations showed that the percentage of fibre in a boll does not decrease as a result of attacks by *T. telarius*, whereas the number of bolls may be decreased by some 35 per cent. The loss of cotton in 1927 caused by the attacks of this mite is estimated at about 1,500 lb. to the acre.

MALENOTTI (E.). **Sulla sistematica dello** *Pseudococcus vitis*, **Niedl., e sui rapporti biologici tra** *Simaethis nemorana*, **Hübn., e** *Pseudococcus citri*, **Risso, e loro importanza in Viticoltura.** [On the Classification of *P. vitis*, and on the biological Relation between *Hemerophila nemorana* and *P. citri*, and its Importance in Viticulture.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) v, pp. 51–62, 9 figs., 16 refs. Verona, 1928.

The identity of *Pseudococcus vitis*, Niedl., is doubtful, but it is certainly not, as hitherto assumed, the species that injures vines in Italy, which is *P. citri*, Risso, a polyphagous mealybug that occurs also on fig trees growing among the vines. In the mild climate of the Italian Riviera, *P. adonidum*, L. (usually found in greenhouses) infests vines in the open. On the fig, *P. citri* is favoured by the shelter afforded by the larval webs of *Hemerophila* (*Simaethis*) *nemorana*, Hb. The webs, however, are not sufficiently numerous to harbour all the Coccids of the last two generations. Any measures against *P. citri* must take into consideration the fig trees. The collection of infested leaves is not difficult in summer, and this prevents the occurrence of the larger September generation of mealybugs which is likely to attack the vines.

SIMMEL (R.). **Die Splintkäfer an Hopfenbuche :** *Eccoptogaster intricatus* **Ratz. und** *E. carpini* **Ratz.-Sippe.** [Scolytids in the Hop-Hornbeam, *Scolytus intricatus* and *S. carpini*.]—*Ent. Bl.*, xxiv, no. 4, pp. 154–171, 4 pls., 2 figs. Berlin, 31st December 1928.

Records are given of numerous observations in Istria on *Scolytus* (*Eccoptogaster*) *intricatus*, Ratz., and *S.* (*E.*) *carpini*, Ratz., in hop-hornbeam [*Ostrya*], and the resultant discovery of the occurrence in that tree of allied species, including an undescribed one.

MARIÉ (P.). **Les hannetons en 1928 dans la région parisienne. Observations nouvelles sur la ponte. Nouveaux essais de produits répulsifs.**—*Rev. Path. vég. Ent. agric.*, xv, fasc. 6, pp. 152–155. Paris, 1928.

Owing to the increase in price of naphthalene since 1925, efforts were made during 1928, which was a flight year for cockchafers [*Melolontha melolontha*, L.] in the vicinity of Paris, to find a more economical repellent for ovipositing females [*R.A.E.*, A, xv, 6]. Inconclusive experiments were made with two proprietary compounds.

FRAPPA (C.). **Note sur un ennemi redoutable des plantations de canne à sucre, de riz et de maïs, à Madagascar.**—*Rev. Path. vég. Ent. agric.*, xv, fasc. 7, pp. 194–197, 4 pls. Paris, 1928.

The greater part of this information on the life-history of the Dynastid, *Heteronychus plebeius*, Klug, has already been noticed

[*R.A.E.*, A, xiii, 616]. In addition to sugar-cane and maize, *H. plebeius* also attacks rice. The larvae, which are not usually considered to be very injurious, live more than a year in the soil, feeding on the rootlets of sugar-cane, and must therefore weaken the plant to a greater or less extent. Although the beetles usually live in the soil, they have never been found at a depth of more than 8 inches, and have been seen in large numbers in irrigation ditches, on paths and along the railway lines in the plantations. In addition to cultivation, the control measures advocated include the collection of adults, the planting of quick-growing varieties of cane, and the use of nitrogenous manures to promote rapid growth and so reduce the period of susceptibility to attack.

Balachowsky (A.). **Note sur l'action des fumigations cyanhydriques sur les oeufs du** *Eulecanium corni* **Bouché.**—*Rev. Path. vég. Ent. agric.*, xv, fasc. 8, pp. 233–234. Paris, 1928.

Since fumigation with hydrocyanic acid gas is generally effective against the principal injurious Coccids, experiments were made in Algeria to determine its action on the eggs of *Lecanium*. Pieces of vine-shoot infested with *Lecanium corni*, Bch., were fumigated in closed containers, and it was found that although small doses of the gas caused a certain delay in hatching, 100 per cent. mortality was only obtained with 7 gms. potassium cyanide to the cubic metre. This explains why effective control of the eggs of *Saissetia oleae*, Bern., on *Citrus* in Algeria was not obtained until the trees were treated at the rate of 9 gms. to the cubic metre.

Chartier (F.). **La "mouche blanche" des serres** (*Trialeurodes vaporariorum* **Westwood**).—*Rev. Path. vég. Ent. agric.*, xv, fasc. 8, pp. 256–258. Paris, 1928.

Brief notes are given on the bionomics of *Trialeurodes vaporariorum*, Westw., which was found infesting a greenhouse in France. Fumigation was carried out with calcium cyanide for periods of 20 hours wth varying dosages against red spider [*Tetranychus telarius*, L.] as well as the Aleurodid, and no injury to plants was observed. On 30th June, with a temperature of 24° C. [75·2° F.] and a dosage of $\frac{1}{4}$ gm. per cu. m., no insects or mites were killed. On 7th July with a temperature of 20–25° C. [68–77° F.] and a dosage of $\frac{1}{3}$ gm. per cu. m., 90 per cent. of *Trialeurodes* were killed together with a few of the mites. On 20th July with a temperature of 21° C. [69·8° F.] and a dosage of $\frac{1}{2}$ gm. per cu. m., 95 per cent. of *Trialeurodes* and 99 per cent. of *Tetranychus* were destroyed. The air in the greenhouse was very dry, particularly during the last experiment, and it seems probable that with slightly increased humidity 100 per cent. mortality would be obtained.

de Joannis (J.). **Quel nom spécifique doit porter l'espèce de Liparide vulgairement nommée "cul-brun"?**—*Encyc. ent.*, Sér. B, III. Lepid., iii, fasc. 3, pp. 99–104. Paris, 1928.

The author discusses and agrees with the rectified nomenclature of *Nygmia phaeorrhoea*, Don. (brown-tail moth) and *Arctornis chrysorrhoea*, L. (gold-tail moth) [*cf. R.A.E.*, A, v, 496].

Gimingham (C. T.). **An introduced Capsid injurious to Orchids.**—*Ent. Mo. Mag.*, lxiv, pp. 272–274, 8 refs. London, December 1928.

Tenthecoris bicolor, Scott (*Eccritotarsus orchidearum*, Reuter), the synonymy of which is discussed, has been found on a consignment of orchids from Brazil. This Capsid reproduces rapidly under hothouse conditions and is capable of doing serious damage to the young leaves and shoots of the plants.

Skinner (E. R.). *Xylonomus brachylabris*, **Kr. (Hymenoptera, Ichneumonidae, Pimplinae), a Species new to Britain.**—*Ent. Mo. Mag.*, lxiv, pp. 277–278. London, December 1928.

During the course of investigations in larch woods in Suffolk, adults, larvae and cocoons of *Xylonomus brachylabris*, Kr., a parasite of *Tetropium gabrieli*, Weise, were found. This Ichneumonid has not previously been recorded from Britain.

Laing (F.). **The Occurrence of** *Dinoderus bifoveolatus* **Woll. in Britain.**—*Ent. Mo. Mag.*, lxv, p. 4. London, January 1929.

Dinoderus bifoveolatus, Woll., which is a well-known pest of grain and flour in other parts of the world, is recorded for the first time from Britain, infesting flour that had been stored for some years in a warehouse in Liverpool.

Fisher (R. C.) & Cann (F. R.). *Xylobiops basilaris*, **Say (Coleoptera, Bostrychidae), the Red-shouldered Twig-borer, in imported Timber.**—*Ent. Mo. Mag.*, lxv, pp. 16–17. London, January 1929.

The Bostrychid, *Xylobiops basilare*, Say (red-shouldered twig-borer) has been recorded twice in imported American timber in Britain, once in oak in association with *Lyctus* spp., particularly with *L. parallelopipedus*, Melsh., and the second time in hickory.

Wardle (R. A.). **The Problems of Applied Entomology.**—8vo, xii + 587 pp., 4 pls., 29 figs. Manchester, The University Press, 1929. Price 30*s.* net.

The first part of this book (pp. 1–247), dealing with general problems of economic entomology, is supplementary to "The Principles of Insect Control" by Wardle and Buckle, published in 1923 [*R.A.E.*, A, xi, 540], and is largely confined to a review of work that has appeared since 1922. The various sections are, however, complete in themselves, and the arrangement is different. Important matter contained in the previous work is in some cases repeated, but some subjects on which little additional work has been done have been omitted. In this way, room has been found for a fairly detailed treatment of certain important aspects of the bionomics and control of insects that were only briefly dealt with previously, such as the ecology of parasites and the theory of insecticides. The first chapter, on host resistance, includes discussions of biological races of insects, insects as vectors of plant diseases, insects for the control of weeds, and the estimation of infestation. The second chapter gives an account of the relation of climate to the development and geographical distribution of insects, and the methods

and apparatus used for estimating the influence of separate meteorological factors. The succeeding chapters deal with tropisms, parasitism, insecticides, and the relation of cultural practices to insect control.

The second part of the book (pp. 248–519) is on entirely original lines; it is a review of all the more important entomological problems of the world, divided into areas on the basis of types of agriculture. Two concluding chapters of this part deal with the destruction of insects in plants or plant products before or after import, the eradication of a dangerous or potentially dangerous insect from a restricted locality, and the practical and administrative aspects of the protection of small or large areas from invasion by insect pests.

A bibliography, an index of authors and a subject index are included.

The book brings together in a convenient compass the results of a large amount of entomological research carried out in the last six years.

WARDLE (R. A.). **The Principles of Applied Zoology.**—8vo, xii + 427 pp., 56 figs. London, &c., Longmans, Green & Co., 1929. Price 21*s.* net.

In this book, the author has attempted to provide a summary of the whole field of applied zoology that will be of value to the student of agriculture, of medicine or of zoology, and to the general reader. The work is divided into four parts, the first devoted to medical and veterinary zoology, the second to agricultural and horticultural zoology and the third to animal industries; the fourth consists of a fairly extensive bibliography, classified by subjects, and an index.

The second part has chapters dealing generally with soil organisms, the classification of insect pests of cultivated crops, their life-cycle distribution and behaviour, and the factors affecting their mortality and control, examples being taken from all parts of the world, and concludes with a chapter on the encouragement of birds. The third part contains a chapter on bee-keeping and one on sericulture and lac culture.

WILKINSON (D. S.). **A Revision of the Indo-Australian Species of the Genus *Apanteles* (Hym. Bracon.).—Parts I-II.**—*Bull. Ent. Res.*, xix, pts. 1–2, pp. 79–105, 109–146, 3 figs. London, August & October 1928.

This paper, a brief notice of which has already been published [*R.A.E.*, A, xvii, 19], includes the following species bred from hosts of economic importance: *Apanteles belippae*, Rohw., from the Limacodid, *Nemeta* (*Belippa*) *lohor*, Moore, in Java; *A. obliquae*, sp. n., from the Arctiid, *Diacrisia obliqua confusa*, Butl., in India; *A. creatonoti*, Vier., from the Arctiids, *Creatonotus albistriga*, Wlk., in India, and (?) *C. transiens*, Wlk., in Malaya; *A. erionotae*, sp. n., from the Hesperiid, *Erionota thrax*, L., in Malaya; *A. acherontiae*, Cram., from the Sphingids, *Acherontia lachesis*, F., in Ceylon, and *A. styx*, Westw., in India; *A. colemani*, Vier., from the Lymantriid, *Notolophus* (*Orgyia*) *posticus*, Wlk., in India; *A. lamprosemae*, sp. n., from a Lymantriid on *Aleuritis montana*, in Malaya; *A. puera*, sp. n., from the Noctuid, *Hyblaea puera*, Cam., in India; *A. phytometrae*, sp. n., from the Noctuids, *Phytometra chalcites*, Esp., on cucumber, etc., in Samoa, and *P. signata*, F., in Sumatra; *A. artonae*, Rohw., from the Zygaenid, *Artona catoxantha*, Hmpsn., in Malaya; *A. taylori*, sp. n., from *Artona*

albicilia, Hmpsn., in Java ; *A. flavipes*, Cam. (*nonagriae*, Vier., *simplicis*, Vier.), from the Pyralid, *Chilo simplex*, Butl., in India and Formosa, and the Noctuid, *Sesamia inferens*, Wlk., in Formosa ; *A. chilocida*, Vier., from *C. simplex* in Japan ; *A. ruidus*, sp. n., and *A. machaeralis*, sp. n., both from the Pyralid, *Pyrausta machaeralis*, Wlk., in India ; *A. antipoda*, Ashm. (*manilae*, Ashm., *sydneyensis*, Cam., *narangae*, Vier.), from the Noctuid, *Naranga diffusa*, Wlk., in Formosa, the Pyralid, *Hypsipyla robusta*, Moore, and the Noctuid, *Perigea capensis*, Guen., both in India and the Noctuids, *Spodoptera mauritia*, Boisd., in Ceylon, and *Agrotis* sp. in New South Wales ; *A. taprobanae*, Cam. (*stauropi*, Vier., *formosae*, Vier.), from the Notodontid, *Stauropus alternus*, Wlk., in India and Java ; *A. tiracholae*, Ashm., from the Noctuid, *Tirachola plagiata*, Wlk., in Ceylon ; *A. hypsipylae*, sp. n., from *Hypsipyla robusta*, in India ; *A. hyblaeae*, sp. n., from *Hyblaea sanguinea*, Gaede, in Samoa and *H. puera* in Java ; *A. araeceri*, sp. n., from the Anthribid, *Araecerus fasciculatus*, DeG., in Java ; *A. tachardiae*, Cam., from lac, *Laccifer* (*Tachardia*), in India ; *A. importunus*, sp. n., from a Pyralid, *Nephopteryx* sp., defoliating *Cassia fistula* in India ; *A. hemitheae*, sp. n., from the Geometrid, *Hemithea costipunctata*, Moore, in Malaya ; *A. expulsus*, Turn., from the Noctuid, *Anticarsia irrorata*, F., in Fiji ; *A. caniae*, sp. n., from the Limacodid, *Cania bilinea*, Wlk., in Java ; *A. heterusiae*, sp. n., from the Zygaenid, *Heterusia cingala*, Moore, on tea in Ceylon ; *A. prodeniae*, Vier., from the Noctuid, *Prodenia litura*, F., in India ; *A. parasae*, Rohw. (*Urogaster philippinensis*, Ashm.), from a Limacodid, *Parasa* sp., in Java ; *A. agilis*, Ashm. (*hidaridis*, Rohw.), from the Hesperiid, *Hidari irava*, Moore, in Dutch E. Indies ; *A. stantoni*, Ashm., from the Pyralids, *Margaronia laticostalis*, Guen., in India, and *M. glauculalis*, Guen., in Malaya, and the Tortricid, *Argyroploce codonectis*, Meyr., in Malaya ; *A. taragamae*, Vier. (*plusiae*, Vier., *omonae*, Rohw.), from the Lasiocampid, *Taragama dorsalis*, Moore, and the Noctuid, *Phytometra peponis*, F. (*Plusia agramma*, Guen.), both in India, and the Tortricid, *Homona coffearia*, Nietn., in Java ; *A. platyedrae*, sp. n., from the Tineids, *Platyedra gossypiella*, Saund., and *Decadarchis heterogramma*, Meyr., in Fiji ; *A. hasorae*, sp. n., from the Hesperiid, *Hasora mixta*, Mab., on *Derris* in Java ; *A. inquisitor*, sp. n., from the Pyralid, *Lamprosema diemenalis*, Guér., in Malaya ; *A. angustibasis*, Gah., from the Pyralid, *Cnaphalocrocis medinalis*, Guen., in the Philippines ; *A. fakhrulhajiae*, Mahdn., from the Tineid, *Holcocera pulverea*, Meyr., in India [*R.A.E.*, A, xiv, 138] ; and *A. nonagriae*, Olliff, from the Noctuid, *Phragmatiphila truncata*, Wlk. (*Nonagria exitiosa*, Oll.) in Australia.

The last three species are unknown to the author or are otherwise of doubtful position.

CHRYSTAL (R. N.). **The *Sirex* Wood-wasps and their Importance in Forestry.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 219–247, 3 pls., 10 figs., 43 refs. London, December 1928.

In this paper on the biology and forest relations of the British species of *Sirex* are included systematic notes by Dr. J. Waterston on these species, with a key, and a general review of the literature. The account of the biology is based on studies of *S. cyaneus*, F., which were carried out near Oxford during 1926–27 in a mixed plantation of Scots

pine [*Pinus sylvestris*] and larch, in connection with the possibility of introducing its parasites into New Zealand against *S. juvencus*, L. [*R.A.E.*, A, xvi, 652]. Some additional notes on *S. gigas*, L., are also given. Detailed descriptions are given of the ovipositor and oviposition of *S. cyaneus*, as well as of its egg, young larva, larval galleries and pupation.

S. gigas flies from June until the autumn, and *S. cyaneus* from the end of July or even later. Pairing takes place at a height and was only noticed in cages on two occasions. *S. cyaneus* was observed to oviposit from August until late September, only larch being attacked. On an average 300–400 eggs were dissected from the egg tubes of large females that were taken in September. On one occasion *S. gigas*, which bred in old spruce [*Picea*] and silver fir [*Abies*] about half a mile distant, was seen ovipositing in a small freshly cut larch log in a sawmill. The incubation period of eggs of *S. cyaneus* is estimated to be 3–4 weeks. The first newly-hatched larva was found on 29th August 1927 and the last on 8th November, but in February 1928 two mature eggs were discovered. The pupal period lasts 5–6 weeks, the pupae occurring at various depths in the wood from late June onwards. The life-cycle is estimated to occupy two years, the larvae requiring about 21 months for their development and probably being one-third to half grown at the end of their first year. In the forest, however, the average life-cycle may be longer, with a possible maximum of 3 years. Both these species have recently been found wintering as adults in silver fir logs in North Devon, but this is considered an uncommon occurrence.

A study of the forest relations of *S. cyaneus* has shown that it is not a primary enemy of healthy green trees, and usually prefers those that are markedly unhealthy, but not quite bare of foliage, the choice being restricted and possibly lying between certain limits of moisture content. Of such trees, particular ones were more heavily attacked, and one of them showed as many as six oviposition tunnels to a square foot of bark in places; six holes containing eggs and larvae once occurred within a half-inch square. Unsuitable soil conditions were the principal factors affecting the health of the larch, which was planted in 1891–92 and varied in diameter (at breast height) from 3 to 9 inches, the average height being from 35 to 40 feet. Trees of all sizes were infested from within six inches of the soil level to the top. In North Devon, where observations were also made, *Fomes annosus*, a root fungus, was the predisposing factor in the case of silver fir attacked by *S. gigas* and *S. cyaneus*; both species occurred in the same tree. The Cerambycid, *Tetropium gabrieli*, Wse., which was also present near Oxford, usually precedes *Sirex*, but these borers may occur simultaneously as indicators of pathological conditions in larch woods.

The wood-wasp problem in New Zealand is briefly discussed, emphasis being laid on the importance of studying the silvicultural conditions in relation to the attacks of *S. juvencus* on *Pinus radiata* [*R.A.E.*, A, xvi, 221; xvii, 106].

WATERSTON (J.). **A new Encyrtid (Hym., Chalcid.) bred from** *Clastoptera* **(Hom., Cercop.).**—*Bull. Ent. Res.*, xix, pt. 3, pp. 249–251, 1 fig. London, December 1928.

Carabunia myersi, gen. et sp. n., was bred from the Cercopid, *Clastoptera* sp., on *Acalypha wilkesiana* in Cuba. The rate of para-

sitism was so high that no adults of *Clastoptera* were reared, and it is therefore proposed to introduce this parasite into Trinidad in the hope that it may attack *Tomaspis saccharina*, Dist. (sugar-cane froghopper).

GAHAN (A. B.), U.S. Bur. Ent. **Some reared Parasitic Hymenoptera from the Sudan.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 255–257, 1 ref. London, December 1928.

The species described include the Chalcid, *Brachymeria sesamiae*, sp. n., and the Eulophid, *Pleurotropis furvum*, sp. n., from pupae of *Sesamia cretica*, Lederer. *Apanteles ruficrus*, Haliday, was reared from a borer (probably *S. cretica*) infesting *Pennisetum typhoideum*, and *Microbracon brevicornis*, Wesm., from larvae of *S. cretica*.

MASSEE (A. M.). **Two Species of Gall-mites (Eriophyidae) of the Lilac (*Syringa vulgaris*, L.) new to Britain.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 259–260, 1 pl. London, December 1928.

Two species of gall-mites infesting lilac, *Eriophyes löwi*, Nal., and *Phyllocoptes massalongoi*, Nal., are recorded for the first time from England. The former, which is the more common, infests newly developing buds, more frequently those towards the tips of the shoots, and the buds dry out completely as a result. The infested twigs become stunted and distorted. The latter lives freely on the leaves, causing a yellowish brown mottling of the upper surface, or attacks the flowers and fruits. In cases of severe infestation the flowers are badly malformed and very few fruits are produced on the flower-heads. Detailed systematic descriptions of these two species are appended.

WILKINSON (D. S.). **New Parasitic Hymenoptera.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 261–265, 2 figs. London, December 1928.

The following new species are described: The Ichneumonid, *Henicospilus euxoae*, from the Noctuid, *Euxoa segetum*, Schiff., in Southern Rhodesia; and the Braconids, *Fornicia ceylonica*, from the Limacodids, *Natada nararia*, Moore, and *Spatulifimbria castaneiceps*, Hmps., in Ceylon; *Apanteles fabiae*, from a Geometrid defoliating *Fabia* sp., in India (United Provinces); and *Amicroplus tasmanicus*, from a Noctuid (probably *Agrotis* sp.), in Tasmania. *Odontofornica*, which contains the single species *O. arata*, Enderlein, is considered to be a synonym of *Fornicia*. A section of the author's key to the Indo-Australian species of *Apanteles* [*R.A.E.*, A, xvii, 153] is revised to include *A. fabiae*.

DAVIES (W. M.). **Notes on the Feeding Habits of *Habrosyne derasa*, L. (Lepidoptera).**—*Bull. Ent. Res.*, xix, pt. 3, pp. 267–270, 8 refs. London, December 1928.

The following is taken largely from the author's summary and conclusions: *Habrosyne derasa*, L. (buff arches moth) was studied with a view to determining whether it was likely to be of use in the biological control of blackberry in New Zealand [*cf. R.A.E.*, A, xv, 318]. Newly hatched larvae thrived equally well on blackberry, loganberry and raspberry. All newly hatched larvae on rose and apple succumbed with one exception, but some of the larvae transferred to these plants

after feeding for 10 days on blackberry survived and pupated normally. Feeding took place to a slight extent on cherry, plum and pear, but no larva pupated. Currants were not damaged, and the larvae soon died. When a choice of food-plants was given, feeding was concentrated on blackberry, loganberry and raspberry. As, however, these plants are attacked indiscriminately, it is considered undesirable to introduce this insect into New Zealand.

Investigations revealed an apparently unique method of oviposition, the eggs of *H. derasa* being deposited on the points of the serrated leaf-edges of the blackberry.

SALT (G.). **A Study of** *Colaspis hypochlora*, **Lefèvre.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 295–308, 1 fig., 7 refs. London, December 1928.

During recent years considerable loss has been caused in the banana-producing area of north-eastern Colombia (and in certain parts of Central America) through the blackened scars on the skin of the fruit caused by the feeding of the adults of the Eumolpid, *Colaspis hypochlora*, Lef. [*cf. R.A.E.*, A, xiv, 618]. The other species of *Colaspis* collected in Colombia are discussed, including *C. lebasi*, Lef., found in the banana fields feeding on a species of *Ipomoea* and occasionally on young banana leaves.

All stages of *C. hypochlora* are briefly described. The eggs are normally laid in the soil at a depth of about $\frac{1}{4}$ in. The larvae hatched in 6 days and seem capable of passing the first two days of their life without food. Moisture is essential to them, and they are always found in damp soil under heaps of rubbish, at the edges of ditches and among the matted grass roots of poorly drained places, usually at a depth of 2 or 3 ins. They soon die if the soil becomes at all dry, and during an unusually dry period they were found 8–10 ins. below the surface. No larvae were found within banana roots [*cf. loc. cit.*] or even about them unless grass roots were also present. On the other hand, all larvae taken in the field were at or near the roots of *Paspalum conjugatum*. The feeding of newly hatched larvae on the epidermal tissues of the roots of this grass was observed. On one occasion larvae, pupae, and a soft adult were taken from the soil among grass roots where they must certainly have developed in the absence of banana roots. Moreover, larvae found in the field have been brought to maturity on the roots of *P. conjugatum*. Pupation takes place in the soil at a depth of 2 or 3 ins., the prepupal stage lasting about two days, and the pupal stage 5–5$\frac{1}{2}$ days. The adult beetle is quick to escape if actually disturbed but otherwise moves very little, and under ordinary circumstances seldom takes wing.

Although the epidermal tissue of the banana fruit is the chief food of the adults, they also feed commonly on the young banana leaves while they are still tightly rolled. In breeding cages, even in the presence of a plentiful supply of bananas, the beetles also eat the young leaves of *P. conjugatum*. A list is given of other plants on the leaves of which they have been found feeding. They prefer shady situations, feeding on the lower surface of the fruit during the day and on the upper exposed surfaces during the hours of darkness. In Colombia there are normally four broods a year, all of which appear during the rainy season, towards the end of April, the end of June, the end of August, and the end of October. They gradually increase in size, from the first, which is small and does little damage, to the fourth, which is the

largest and causes the heaviest loss. Each brood remains active on the fruit for about four or five weeks. During the dry season (December to April), adult beetles are very rare in the plantations, and it is almost certain that this period is passed in the larval stage. During November the half-grown larvae probably begin to feel the drying of the soil, and to avoid desiccation burrow downwards to pass the ensuing three months in resting chambers at a considerable depth. The reduction in the number of adults appearing the following April is probably due to the fact that the larvae have been exposed to drying (or drowning at times of irrigation) and to the attacks of their natural enemies for a period of three or four months instead of only a few weeks.

Surveys made to determine the localities where the beetles were most abundant showed that definite centres of infestation occurred and that the injury was greatest in damp districts, particularly where the drainage was poor or the ground covered with grass and bush. The adult beetles feed near their breeding-places, and the distribution of scarred fruit is really dependent on that of the larvae.

Very few natural enemies of *C. hypochlora* have been reported, and the possibilities of biological control are unknown. The use of fumigants against the larvae and of repellents or insecticides against the adults are considered impracticable, and the results of experimental dusting with calcium arsenate were not sufficiently satisfactory to warrant its adoption. Hand-collection of the adults is considered ineffectual at the present stage of infestation, and the author regards cultural methods as the best and perhaps the only practicable means of control. These only involve an improvement in the usual farming operations, and they destroy the insect at the most suitable and economic period.

The following recommendations are made: Large, low-lying tracts of land should be kept well-drained and the numerous small ditches kept clean and functional; banana fields should be kept clean and as free as possible from grass and weeds that form a close cover; shovel-cleaning should entirely supersede machete-cleaning; and farmers should be notified in advance of the appearance of the larval broods so that they may arrange, at any rate in badly infested areas, to do most of the cleaning at the optimum time.

MYERS (J. G.). **Further Biological Notes on** *Rhyssa* **and** *Ibalia*, **parasitising** *Sirex cyaneus*, **Fabr.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 317–323, 4 refs. London, December 1928.

The work of collecting and rearing supplies of *Rhyssa persuasoria*, L., and *Ibalia leucospoides*, Hochenw., parasites of *Sirex cyaneus*, F., for shipment to New Zealand for the biological control of *S. juvencus*, L., has been continued on a larger scale [*cf. R.A.E.*, A, xvi, 652]. The pairing and oviposition of *R. persuasoria* are described in detail. In some cases unfertilised females oviposited and produced offspring. Examination of the larvae of *S. cyaneus* from larch logs during January and March 1928 showed the rate of parasitism by *I. leucospoides* to be 5·9 per cent. In one case a larva of *R. persuasoria* was found on a pupa of *I. leucospoides*, and although such hyper-parasitism is possibly not of frequent occurrence, the author points out that owing to the changed course of the borings of parasitised larvae [*loc. cit.*], the larva or pupa of *I. leucospoides* is never out of reach of the ovipositor of *R. persuasoria*.

Bondar (G.). **O "chupança do cacáo."** [*Monalonion xanthophilus.*]—*Bol. Minist. Agric. Ind. Comm.*, xvii (ii), no. 1, pp. 60–63. Rio de Janeiro, July 1928.

The Capsid infesting cacao in Bahia, Brazil, commonly called "mosquilla vastatrix," is *Monalonion xanthophilus*, Wlk. In Ecuador, cacao is attacked by two species, *M. atratum*, Dist., and *M. dissimulatum* Dist., both generally known as mosquilla and causing considerable injury. The species in Bahia is common in the forest region on a wild fig (*Urostigma*), causing black spots on the leaves. Cacao has been planted in Bahia for over a hundred years, but this Capsid only occurs rarely on it, infesting individual trees here or there, as it is kept in check by its natural enemies. The measures recommended include the protection of insectivorous birds, and brushing off the larvae, spraying with kerosene emulsion, or singeing the infested pods.

Bondar (G.). **Uma praga do amendoim,** *Parastega* (*Gelechia*) *bosquella* **Chambers.** [*Stegasta bosquella*, a Pest of Ground-nuts.]—*Chacaras e Quintaes*, xxxviii, no. 5, p. 490, 1 fig. S. Paulo, 15th November 1928.

The Tineid, *Stegasta* (*Parastega*) *bosquella*, Chambers, has been observed severely infesting ground-nuts [*Arachis hypogaea*] in Bahia, this being the first record of it from Brazil. Descriptions of the larva and adult are given. Spraying with Paris green is suggested, as the liquid can penetrate into the leaf-axils in which the eggs are laid and the larvae shelter.

de Andrade (E. Navarro). **Contribuição para o estudo da entomologia florestal Paulista.** [A Contribution to the Study of Forest Entomology in S. Paulo.]—*Bol. biol.*, no. 6, pp. 66–72. S. Paulo, 26th May 1927.

Forest pests in S. Paulo include the Lamiid beetles, *Oncideres dejeani*, Thoms., on various plants, and *O. amputator*, F., on *Eucalyptus*; a Curculionid, *Rhinastus sternicornis*, Germ., on bamboos [*R.A.E.*, A, xv, 524]; and various leaf-eating caterpillars such as *Brassolis astyra*, Godt., parasitised by a fly, *Xanthozona*, which destroys 75 per cent. of the cocoons.

Kelsick (R. E.) & Howell (W. I.). **Work in Connection with Insect and Fungus Pests and their Control.**—*Rep. Agric. Dept. St. Kitts-Nevis 1927–28*, pp. 4–6 & 19–20. [Trinidad] 1928.

In St. Kitts, *Alabama argillacea*, Hb. (cotton worm) caused severe injury in certain districts towards the end of the season. Satisfactory control was obtained with undiluted calcium arsenate dust. In Nevis this pest was much less injurious than in the two previous years, and although there was a slight outbreak in November, when the cotton plants were just above the ground, and a more serious attack during January and February, little damage was done except in a few fields where no control measures were carried out. Although *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm) was scarce in Nevis, and boll shedding did not occur to any extent, it caused considerable damage to the cotton crop in St. Kitts. Unfortunately, the planting of cotton in Nevis is begun on 1st November, whereas in St. Kitts

it is not begun until the following March, so that bolls are forming in St. Kitts at the time the bollworm attack is at its maximum in Nevis. Larvae and moths are probably brought from Nevis in bags used by peasants for storing seed cotton and subsequently employed for bringing their provisions to the St. Kitts market. It is also possible that the moths are capable of flying the eleven miles from Nevis to St. Kitts. In Nevis the cotton leaf blister mite [*Eriophyes gossypii*, Banks] only occurred in a few places where the borders of the fields had not been properly cleared, and only a few individuals of the cotton stainer [*Dysdercus andreae*, L.] were seen towards the end of the season, the cotton being practically free from stains.

KOPP (A.). **Le " ver " de la canne à sucre aux Antilles françaises.** (*Diatraea saccharalis.*)—*Rev. Bot. appl.*, viii, no. 87, pp. 755–767, 12 refs. Paris, November 1928.

An account is given of the bionomics of *Diatraea saccharalis*, F., as occurring in the French Antilles, where, although it attacks a considerable percentage of the sugar-cane, the damage done is not considered sufficient to warrant expensive remedial measures. Investigations in Guadeloupe have shown that in addition to the injury observed in the cut canes, some plants are killed by the borer, and many of the young shoots fail to develop. The remedial and preventive measures are discussed [*R.A.E.*, A, xii, 318; xv, 97, 186; xvi, 463, etc.]. The best method of destroying the larvae is immersion of the slips in water at a temperature of 50° C. [122° F.] for 20 minutes. A list of the known parasites is given, of which the most important, *Trichogramma minutum*, Riley, is the only one known to occur in Guadeloupe. The susceptibility of different varieties of cane to the borer is discussed; in general the canes offering the most leafy shelter to the adults and those with the softest epidermis are the most heavily infested.

RUHMANN (M. H.). **Report of the Assistant Entomologist, Vernon.**—*22nd Ann. Rep. Br. Columbia Dept. Agric. 1927*, pp. Q37–Q41. Victoria, B.C., 1928.

Onions in parts of British Columbia were severely injured by *Hylemyia antiqua*, Mg. (onion maggot) in 1927; the application of mercury bichloride is the most satisfactory method of control. Wireworms are serious pests of vegetables in the Okanagan districts and owing to the increasing importance of tobacco growing, tests were carried out for the control of these pests with baits of rice shorts roasted or unroasted, and used alone or combined with amyl acetate, sodium fluoride or paradichlorobenzene, the materials being mixed and made into a dough. It was found that the difference in captures with roasted and unroasted baits did not justify the time and expense necessary for roasting. The attractiveness of the baits was increased by amyl acetate, but diminished by sodium fluoride or paradichlorobenzene, which also had no apparent toxic effect on the wireworms. Though considerable numbers were caught, onions in the baited area appeared to be as severely injured as those in the unbaited area.

An outbreak of *Anabrus simplex*, Hald. (mormon cricket), which threatened to be very severe, was averted by the cold wet weather of the

greater part of the spring and summer, which prevented the maturing of the crickets.

Orchard pests mentioned are *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm. (woolly apple aphis), *Enarmonia prunivora*, Walsh (lesser apple-worm), *Eriophyes pyri*, Pag. (blister mite), and *Cydia pomonella*, L., which was recorded from three districts not previously known to be infested.

ALDRICH (J. M.). **A new Species of** *Oedematocera* **with Notes on** *Schistocercophaga* **Townsend (Dipt. : Tachinidae).**—*Ent. News*, xxxix, no. 10, pp. 301–304. Philadelphia, Pa., December 1928.

The author points out that *Oedematocera dampfi*, Aldrich, for which Townsend erected the new genus *Schistocercophaga* [*R.A.E.*, A, xvi, 506], is correctly referable to the former genus, as it closely resembles the type species, *O. flaveola*, Coq. A key to the species of *Oedematocera* is given.

CHRISTIE (J. R.). **Notes on larval Nemas from Insects.**—*J. Parasit.*, xv, no. 2, pp. 127–130, 1 fig. Urbana, Ill., December 1928.

The Nematode, *Agamospirura melanopli*, sp. n., is described from the grasshopper, *Melanoplus femur-rubrum*, DeG., in the United States. Although certain Blattids often serve as intermediate hosts for Spirurid Nematodes, they do not seem to have been previously recorded from grasshoppers.

SCHOENE (W. J.), HOUGH (W. S.), STEARNS (L. A.), CAGLE (L. R.), WILLEY (C. R.) & WOODSIDE (A. M.). **Life History of the Codling Moth in Virginia.**—*Bull. Virginia Agric. Expt. Sta.*, no. 261, 56 pp., 7 figs. Blacksburg, Va., March 1928.

This bulletin records the results of life-history studies of the codling moth [*Cydia pomonella*, L.] undertaken in Virginia during the past seven years, the observations being summarised in a series of tables. The investigations were carried out in different parts of the State, and the most important deduction derived from them is that the life-history of *C. pomonella* is highly variable. It is influenced considerably by differences in elevation, exposure and latitude of the orchard in which it occurs, development being also more rapid in warm than in cool weather. It is therefore impossible to make correct recommendations for orchard treatment without occasional observations on the development of the insect.

UNDERHILL (G. W.). **Life History and Control of the Pale-striped and Banded Flea Beetles.**—*Bull. Virginia Agric. Expt. Sta.*, no. 264, 20 pp., 8 figs., 15 refs. Blacksburg, Va., June 1928.

Systena blanda, Melsh. (pale-striped flea-beetle) and *S. taeniata*, Say (banded flea-beetle), the stages of which are described, are closely related native species of wide distribution in the United States and southern Canada. Their habits are similar, and they are frequently found in association in the field. The larvae feed on the roots of weeds. During most of the season the adults live on weeds, without causing any injury to cultivated plants, but when they emerge in the spring

the weeds are often too small to support them, and considerable damage may then be done in a few days to vegetable and field crops that are just coming through the ground or are in the seedling stage. Occasionally the beetles may remain on beans and other crops throughout the season. *S. blanda* is the commoner of the two and the more injurious; both have a large range of food-plants, a list of them being given. *S. blanda* has two distinct generations in Virginia and overwinters as a larva; *S. taeniata* has one complete and a partial second generation, and it passes the winter as an adult. The adults of this species emerge in March and early April, and those of *S. blanda* in late May or early June. Eggs are deposited just below the surface of the soil beneath the food-plants. The first generation of *S. blanda* emerges as adults about 40 days after oviposition. The first generation of *S. taeniata* requires about 8–9 weeks for development to the adult stage, and the partial second generation requires about 8 weeks. In laboratory tests, calcium arsenate, lead arsenate and zinc Bordeaux applied as dusts successfully destroyed the beetles. Zinc Bordeaux, either undiluted or mixed with 8 parts of lime, killed the insects more rapidly than any other poison, calcium arsenate with 8 parts lime being second. Lead arsenate and sodium fluosilicate were slower in their effect, but gave fair results. The varying proportions of arsenate suitable for dusting or spraying different crops are discussed. Wild food-plants should be ploughed under in late August or early September, when oviposition of *S. blanda* is over; many late developing larvae of *S. taeniata* are also destroyed in this way, and adults of the same species may be destroyed by autumn or winter ploughing and cleaning up of wild food-plants in hedges, etc.

PACKARD (C. M.). **The Hessian Fly in California.**—*Tech. Bull. U.S. Dept. Agric.*, no. 81, 25 pp., 2 figs., 12 refs. Washington, D.C., November 1928.

The following is largely taken from the author's summary: In California *Mayetiola* (*Phytophaga*) *destructor*, Say (Hessian fly) is abundant only where the summer climate is distinctly affected by the modifying influence of the ocean. It injures the wheat crop to a slight extent almost every year and causes serious damage when climatic conditions are particularly favourable. The summer, autumn and winter are passed in puparia in the stubble. Most of the adults emerge in March, though some emerge from young wheat in late April. A few adults, however, may emerge earlier and oviposit in February, and some of the earliest larvae pupate and emerge as adults in late April and early May, giving rise to a minor second generation. Heavy rains in September have been known to cause the emergence of most of the flies from the stubble. Injury to wheat is caused by the feeding of the larvae underneath the leaf sheaths during March, April and May.

Six Chalcid parasites have been bred from *M. destructor* in California, viz.: *Merisus destructor*, Say, *Eupelmus allyni*, French, *Eupteromalus micropterus*, Lind., *Pseuderimerus mayetiolae*, Gah., *Eutelus mayetiolae*, Gah., and *Calosota metallica*, Gah. The first three are common throughout the United States, *P. mayetiolae* occurs only in California, and the last two only on the Pacific Coast. The last three are new species reared during the course of this investigation. All the species oviposit in the puparia of the host during the spring and summer,

and a mortality of 5 50 per cent. results every year, the percentage varying considerably in different localities and different seasons. During the years 1916–25 parasitism was not the dominant factor in limiting the abundance of *M. destructor*. Attempts to establish *Platygaster vernalis*, Myers, an important parasite of *M. destructor* in the Eastern States, has so far been unsuccessful.

The artificial methods of control used in the East cannot be applied in California because of the radically different climatic conditions. Burning stubble, ploughing it under and throwing it out upon the surface by cultivation in early summer to cause desiccation of the puparia are of some value, but these methods cannot be universally applied. The most practical measures, crop rotation, early planting and the stimulation of rapid vigorous growth, are already in use for other purposes.

Plant Quarantine Act, August 20, 1912, as amended March 4, 1913, March 4, 1917, May 31, 1920, April 13, 1926 and May 1, 1928.— 5 pp. Washington, D.C., October 1928.

This Act provides for the regulation of the importation into the United States of nursery stock and other plants and plant products, the establishment and maintenance of quarantine districts for plant diseases and insect pests, and the regulation of the movement of fruits, plants, vegetables, etc. [NOTE.—The functions of the Federal Horticultural Board since 1st July 1928 have devolved upon and are exercised by the Plant Quarantine and Control Administration.]

Quarantine on account of the Satin Moth, with revised Regulations. Notice of Quarantine no. 53, revised.— *U.S. Dept. Agric., P.Q.C.A.*, 4 pp., 2 maps. Washington, D.C., December 1928.

These regulations, superseding previous ones [*R.A.E.*, A, xv, 192], and which became effective 1st January 1929, extend the area quarantined on account of *Stilpnotia salicis*, L., including parts of Vermont, and prohibit the movement of poplar and willow trees from the quarantined areas, on account of the practical impossibility of satisfactorily determining by inspection whether such trees are free from infestation, owing to the habit of the larvae of hibernating in inconspicuous webs on the bark of the trees.

Narcissus Bulb Quarantine (no. 62). Calcium Cyanide Fumigation for Bulb-fly Control authorised. (P.Q.C.A.—217, revised.)— *U.S. Dept. Agric., P.Q.C.A.*, S.R.A. no. 96, pp. 79–80. Washington, D.C., December 1928.

As an alternative to measures required [*R.A.E.*, A, xiv, 492] against the narcissus bulb flies [*Merodon equestris*, F., and *Eumerus* spp.], fumigation by calcium cyanide is authorised, except where eelworm is present, when the hot water treatment is necessary. The bulbs must be fumigated at a temperature of not less than 60° F., with 12 oz. calcium cyanide dust (slowly evolving type) to 100 cu. ft. space in an air-tight chamber for not less than 4 hours, the dust being scattered

in an even, thin layer on the floor of the chamber below the trays of bulbs, each tray containing not more than 2 layers of bulbs.

Experiments in 1927 and 1928 showed that calcium cyanide destroyed the eggs, larvae and pupae of the flies. Fumigation boxes or units of a capacity of about 100–150 cu. ft. are approved ; further experiments may permit of the authorisation of larger ones. The types of fumigation chamber to be used are described.

Jones (F. M.) & Parks (H. B.). **The Bagworms of Texas.**—*Bull. Texas Agric. Expt. Sta.*, no. 382, 36 pp., 21 figs. College Station, Texas, July 1928.

Notes are given on the bionomics and distribution of 13 species of Psychids from Texas, and of 3 others not yet recorded from this State ; several of those mentioned are capable of becoming major pests of almost all the native species of ornamental and shade trees, injury to which has usually been accredited to *Thyridopteryx ephemeraeformis*, Haw. (evergreen bagworm). They attack a large variety of plants and are often more abundant on cultivated trees and shrubs than on their original wild food-plants. The larval stage is passed in a tough portable silken case, with an opening at either end, into which the larva retires at the least alarm. The feeding period generally lasts throughout the summer, and in some species is resumed in the following spring. Before pupation the larva reverses its position in the bag and hangs with its head downwards towards the narrow lower opening. The bags sometimes remain attached by silken threads to the tree even after the emergence of the moth, and these stop the normal flow of sap and cause a gall-like growth that weakens and even kills the twig. The duration of the pupal stage varies according to the season, but does not usually exceed a month. The adults may emerge at any time of day, but there is a definite maximum emergence period for each species. Eggs are laid in the bag almost immediately after mating, and after a few hours the female drops to the ground to die, the bag closing tightly behind her. In a number of species hibernation takes place in the egg stage ; all the larvae from eggs laid by one individual hatch simultaneously in the spring, build their silken cases and disperse in search of food. Larvae tend to continue feeding on the same variety of food-plant as that on which they hatch, even if offered another favourite variety, although bags are occasionally found that clearly indicate that several changes have been made. Thus races connected with specific food-plants may persist for a number of years, but these associations ultimately break down through failure of the food-supply and the chance dispersal of some of the larvae to other plants. Winds often transport the young larvae as they let themselves down by threads or release their hold of the foliage or twigs. Diseases and insect parasites play an important part in holding bagworm infestations in check and are probably responsible for the irregularity of injurious outbreaks.

The two most destructive species in Texas are *T. ephemeraeformis* and *Oeceticus* (*Oiketicus*) *abboti*, Grote (live-oak bagworm), which are, however, almost entirely confined to the eastern half of the State ; *T. ephemeraeformis* is the easier to control, as all the larvae of this species hatch at about the same time in spring, whereas the life-cycle of *O. abboti* is irregular.

Hand-picking the bags is the most satisfactory means of control, but where this is not practicable, spraying with lead arsenate (2 lb. paste to 50 U.S. gals. water) is advocated; applications should be made when the larvae are young.

ADAIR (H. S.), U.S. Bur. Ent. **Black Pit of Pecan.**—*Amer. Nut J.*, xxvi, no. 1, reprint 1 p. Rochester, N.Y., January 1927.

An investigation in Texas of apparently sound pecan nuts that had fallen from the trees in numbers about midsummer, with evidence of the condition known as black pit, showed that they were invariably punctured. As the condition of the nuts somewhat resembled kernel spot caused by *Nezara viridula*, L. (green stink bug) [*R.A.E.*, A, xii, 1], cage experiments were made with bugs found on pecan trees. *Euschistus euschistoides*, Voll., and *Leptoglossus oppositus*, Say, were found to puncture the nuts freely, causing them to drop from the trees in 6 to 10 days, showing the characteristic discolouration of black pit. Wherever the insects were observed, there was a heavy drop of pecans affected with black pit, and it is concluded that although other factors may be involved, the evidence thus far limits the injury to attack by insects.

EDDY (C. O.). **Cotton Flea Hopper Studies of 1927 and 1928.**—*Bull. S. Carolina Agric. Expt. Sta.*, no. 251, 18 pp., 3 figs., 6 refs. Clemson College, S.C., October 1928.

Further studies on the bionomics and control of *Psallus seriatus*, Reut. (cotton flea-hopper) in South Carolina have confirmed those already noticed [*R.A.E.*, A, xv, 404; xvi, 457]. The activities of this Capsid during the past four years indicate that it is capable of becoming a serious pest whenever the environmental conditions are favourable. During 1927 and 1928, no stages were found in sufficient numbers on cotton to be of economic importance; in 1927 the numbers of the insect increased rapidly until towards the middle of June, causing slight injury to seedling cotton, but declined rapidly during the middle and end of the month, when a cold rainy period set in and the evening primrose [*Oenothera*], which is an important food-plant during its early seasonal development, matured and died. In the late summer the Capsid developed in sufficient numbers to cause the blasting of enough squares to affect cotton production. Injury to cotton in 1927 and 1928 was in the main unlike that of 1926 [xv, 404], much of it being probably due to adverse weather conditions and disease; cotton that germinated and started growth before the middle of May was retarded and severely malformed and frequently showed an unhealthy reddish colour. Cage experiments with cotton seedlings show that nymphs and adults injure the terminal buds and cause abnormal and retarded growth, and mechanical injury to the plants gave very similar results; it is possible, however, that *P. seriatus* may either transmit a virus or inject some poison into the plants, as the damage is greater than would seem probable from the mechanical injury it causes.

In addition to control measures already noticed, a mixture of 2 lb. sulphur to 1 lb. calcium arsenate is recommended for use in fields infested with the boll weevil [*Anthonomus grandis*, Boh.] as well as *P. seriatus*.

Weiss (H. B.). **Results of the Eighth Year's Work against the Gipsy Moth in New Jersey.**—*Circ. New Jersey Dept. Agric.*, no. 150, 10 pp., 2 maps. Trenton, N.J., October 1928.

A very brief account is given of the campaign against the gipsy moth [*Porthetria dispar*, L.] during 1927–28, with tables summarising the work of previous years. There has been an almost progressive decline in the number of colonies and egg-masses found since the work was started in 1920–21.

Sweetman (H. L.). **Notes on Insects inhabiting the Roots of Weeds.**—*Ann. Ent. Soc. Amer.*, xxi, no. 4, pp. 594–600. Columbus, Ohio, December 1928.

Owing to the prevalence of weeds in and near cultivated fields, a study was made in Iowa of the insects infesting their roots. These comprised about 75 different species of seven different orders, and lists are given of them and of the plants on which they were found.

Clausen (C. P.). *Hyperalonia oenomaus* **Rond., a Parasite of** *Tiphia* **Larvae (Dip., Bombyliidae).**—*Ann. Ent. Soc. Amer.*, xxi, no. 4, pp. 642–658, 1 pl., 1 fig., 14 refs. Columbus, Ohio, December 1928.

During 1925 more than 60 per cent. of the overwintering cocoons of a large species of *Tiphia* parasitic on the grubs of *Anomala dimidiata*, Hope, in India, were themselves parasitised by the Bombyliid, *Hyperalonia oenomaus*, Rond. Since several other species of *Hyperalonia* were present in small numbers in the cocoons of various species of *Tiphia* that were being imported into the United States for the control of *Popillia japonica*, Newm. (Japanese beetle), a study of the biology of *H. oenomaus* was made to determine the relation of the habits of this family to the present methods of breeding and importing parasites.

The species of *Tiphia* under observation passes the winter in the mature larval stage in cocoons in the soil. The adults begin to emerge at the end of May, reach their maximum numbers by 10th June, and persist in the field until about 20th July. Occasional adults, apparently representing a partial second generation, may be found until the end of September. The eggs hatch in 4–6 days at summer temperatures, and the larvae feed for 15–20 days. *H. oenomaus* has a single generation a year and passes the winter as a mature larva in the cocoon of its host. Pupation occurs in the middle of June, and the first adults appear in the field about 10th July. They reach their maximum numbers within ten days, and the last females are found during the first few days of September. The greater proportion of the larvae of *Tiphia* have spun their cocoons before the adult Bombyliids appear. Field collections showed that the rate of parasitism of the overwintering cocoons of *Tiphia* ranged from 65·3 per cent. on 17th March to 57·6 on 2nd August (when the Scoliids had emerged from the unparasitised cocoons). Collections of the larvae and eggs of the new generation of *Tiphia* developing on grubs during June, July and August yielded

no parasites, whereas cocoons of this generation collected at intervals from 3rd July to 30th September showed a rate of parasitism ranging from 1·9 per cent. on 2nd August to 56·3 per cent. on 30th September. This result confirmed the conclusion previously reached that *H. oenomaus* does not gain access to its host prior to the formation of the cocoon. The increase in the rate of parasitism is very pronounced after 7th September, and since the last adults of the Bombyliid were found in the field about 4th September, it would appear that the time spent by the primary larva in the soil in search of the host cocoons is relatively long, probably from one to three weeks. The eggs are apparently laid on the surface of the soil or are dropped there during flight. The largest number of eggs found in dissected females was 537, but since the life of the female is relatively long, the total number of eggs laid by a single individual may be many times that number. The mature pupa of the Bombyliid emerges from the host cocoon and makes its way to the surface of the soil before the adult emerges.

Although under normal conditions *Hyperalonia* attacks the mature larvae of *Tiphia*, development occasionally takes place on the pupae. *H. oenomaus* was reared in small numbers from the cocoons of several other species of *Tiphia* and from those of *Campsomeris* and *Scolia*. It seems probable that this species is capable of effectively parasitising any Scoliid cocoon of sufficient size, the relative proportion of those attacked depending on the physical condition of the soil inhabited by the grubs on which the Scoliids feed, and upon the depth at which the host cocoons are normally formed. Certain species of *Tiphia* are immune from attack because the hosts to which they are restricted inhabit heavy soil, and cocoons of *Scolia* and *Campsomeris* are seldom attacked because the host grubs are carried to too great a depth by the female parasites before the eggs are laid.

The host relationships of the Bombyliids are discussed, and a list is given of eighteen species with the various orders, families and genera attacked. The only new record, with the exception of those already mentioned, is that of *Aphoebantus* spp. parasitic on *Tiphia* in Assam. The biology of this family is described from the literature, and descriptions of the immature stages of *Hyperalonia oenomaus* are given.

Kunhi Kannan (K.). **The large Citrus Borer of South India,** *Chelidonium cinctum* (**Guér.**).—*Bull. Dept. Agric. Mysore,* Ent. Ser., no. 8, 24 pp., 3 pls., 10 figs., 6 refs. Bangalore, 1928.

Brief notes are given on several insects that bore into the stems of *Citrus* in India, with a detailed account of *Chelidonium cinctum*, Guér. (large citrus borer of South India), of which the salient points have been recorded by the author in a shorter paper [*R.A.E.*, A, xii, 60]. Though the citrus borers occurring in Mysore and in Coorg are identical, there has been some confusion over them, the latter having been recorded at one time as *Chloridolum alcmene*, Thoms. The author compares the life-histories as occurring in the two regions. The treatment is the same for both, but the time for operating is different. The removal of infested twigs should be done once about the end of November and again about the end of January, but in Coorg and the western parts of Mysore the insect has a two-year life-cycle and remedies are necessary only every other year.

WAGLE (P. V.). **Studies in the Shedding of Mango Flowers and Fruits, Part I.**—*Mem. Dept. Agric. India*, Bot. Ser., xv, no. 8, pp. 219–249, 5 pls., 10 refs. Calcutta, May 1928.

Investigations to determine how far the shedding of the flowers and fruits of mango in Bombay is due to Jassids showed that *Idiocerus niveosparsus*, Leth., the principal species observed, materially affects the proportion of flowers that produce fruits. The leafhoppers are most numerous in January and early February and are frequently found associated with a mildew, *Erysiphe cichoracearum*. Spraying with fish-oil soap is only moderately effective, since the flowers become infested again almost immediately. In 1926–27, however, spraying infested plants increased the yield of ripe fruits by 62 per cent. in the flower-heads under examination.

The eggs of *I. niveosparsus* are laid in the mid-ribs of young leaves, generally on the lower surface, or in the axis of the flower-head, and hatch in 5–6 days. The adults appear 10–11 days later. They breed at any time of the year, if there is suitable food for the nymphs in the form of flower-heads or tender vegetative shoots. The adults are always found on the leaves, except at the flowering season, when they mostly rest on the flower shoots. This is also the case with *I. clypealis*, Leth., but *I. atkinsoni*, Leth., is generally found on the stems by day and on the lower surfaces of leaves at night. *I. niveosparsus* sometimes occurs on leaves of *Citrus*. These leafhoppers are very susceptible to high temperatures, but live for a long time in a cool place. Shady gardens are therefore more affected than open, sunny ones. The nymphs, which do most damage, and the adults both feed on the stalks of the inflorescence. There is considerable variation in the prevalence of the leafhoppers during the season and also from year to year.

CHOPRA (R. L.). **Annual Report of the Entomologist to the Government, Punjab, Lyallpur, for the Year 1926-27.**—*Rep. Dept. Agric. Punjab 1926–27*, pt. 2, vol. i, pp. 43–69. Lahore, 1928.

Many of the insects discussed have already been mentioned in the previous report [*R.A.E.*, A, xvi, 419] ; further notes are given on their life-history in many cases.

Observations on the extent of the injury caused by *Platyedra gossypiella*, Saund., and spotted bollworms [*Earias* spp.] to different parts of the cotton plant are shown in tables. *Malvastrum tricuspidatum* is recorded as an additional food-plant of *P. gossypiella*, *E. insulana*, Boisd., and *E. fabia*, Stoll. The life-cycle of *Phycita infusella*, Meyr. (cotton bud caterpillar) was found to occupy about 39 days in July and August. Minor pests of cotton not mentioned in last year's report [*loc. cit.*] include *Tarache nitidula*, F., and *Chrotogonus* sp., which was effectively controlled by means of light traps. The parasites reared include *Microbracon* (*Bracon*) *kitcheneri*, D. & G., from *Phycita infusella*, *Glyptomorpha deesae*, Cam., from *Euproctis lunata*, Wlk., *Fileanta rufocauda*, Cam., from *Agrotis flammatra*, Schiff., and *Brachymeria* (*Chalcis*) *tachardiae*, Cam., from *Parnara mathias*, F. Experiments to determine the influence of varying temperature and humidity on double cotton seeds containing long-cycle larvae of *P. gossypiella* seem to show that with a high degree of humidity the larvae succumb fairly quickly at ordinary temperatures. Stored cotton appears to be

the main source of infestation by *P. gossypiella*. *Myllocerus undecimpustulatus* var. *maculosus*, Desbr. (white cotton weevil) hibernates from November until May, and it was found that ploughing reduces the number of larvae.

The injury caused by borers to sugar-cane ranged from 12 to 40 per cent., and in one case reached 67 per cent., *Diatraea auricilia*, Dudg., being responsible for most of the damage. Investigations into the effect of removing " dead hearts " showed that 70–80 per cent. of the plants tillered better than those from which the affected shoot had not been removed, and, moreover, in the latter case the number of " dead hearts " increased in comparison with those on the treated plants. Burying stubble to a depth of 3 inches was found sufficient to kill all hibernating larvae, and this treatment, together with the use of light-traps, considerably reduced the percentage of infestation. Further observations were made on the life-history of *Pyrilla* spp. on sugar-cane. The nymphs were parasitised by *Dryinus pyrillae*, Kieff., from October to December.

Although rice is believed to be the chief food-plant of *Leptocorisa varicornis*, F., this bug also occurs on the ears of *Panicum colonum*. *Dasychira securis*, Hb., which was heavily parasitised by Tachinids, was found feeding on maize, jowar [*Sorghum*], rice, sugar-cane and certain grasses. Observations on *Scirpophaga* (rice stem-borer) showed that the egg stage lasts 5–6 days in September; in July the larval stage lasted 25–27 days, and the pupal stage about a week. Other borers of rice were *Sesamia*, *Chilo* and *Diatraea*, and laboratory experiments showed that 100 per cent. of the larvae were killed after 6 months if rice stubble was buried at a depth of 6–9 inches.

Notes are given on the life-history of four Aleurodids, *Dialeurodes elongata*, Dozier, *Aleurocanthus woglumi*, Ashby, *Aleurolobus marlatti*, Quaint., and *Tetraleurodes citriculus*, Dozier, attacking *Citrus*. Successful results were obtained by spraying the pupae with resin compound and solignum (1 : 8) and kerosene emulsion (1 : 6). Notes are given on the life-history of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq. (melon fly). In tests with attractants for *D.* (*C.*) *zonatus*, Saund., which is a serious pest of peaches [*cf. R.A.E.*, A, xvi, 421], euginol was found to be highly effective. Fruit infested with larvae and pupae of fruit-flies was buried at various depths to prevent the emergence of adults; it was found that a depth of 4–5 ft. was fairly effective.

Light-traps proved very effective against *Amsacta*, and some 300,000 insects were trapped in two districts compared with 36,000 in the previous year.

Both empty and full warehouses infested with the khapra beetle [*Trogoderma granarium*, Everts], and other pests of stored grain, were successfully fumigated with hydrocyanic acid gas, using 8 lb. potassium cyanide, 10 lb. sulphuric acid and 24 lb. water to 11,000 cu. ft., with an exposure of 72 hours.

Against the attacks of termites, satisfactory results were obtained by treating chillies [*Capsicum*] and sugar-cane setts with crude oil emulsion. Wheat was treated with solutions of various insecticides, and it was found that mercury bichloride (at less than 0·25 per cent.) and arsenic (at 0·5 per cent.) were very efficient deterrents and at the same time did not affect the germination of the grain.

A list is given showing the stomach contents and economic importance of some of the more common birds. The bionomics and control of locusts are also discussed. The various measures used included

burying, burning, spraying, dusting and the use of poison baits, and the weight of insects killed by some of these methods is given in a table.

Brown (G.). **The Economic Value of Birds in Ceylon.**—*Trop. Agriculturist*, lxxi, no. 5, pp. 272–280. Peradeniya, November 1928.

The food of various birds in Ceylon is discussed, and the author concludes that some of them are of considerable value in the control of insects.

Lloyd (W.). **I principali nemici dell'** *Hevea brasiliensis*. [The chief Diseases and Pests of *H. brasiliensis*.]—*Agricolt. colon.*, xxii, no. 11, pp. 417–426. Florence, November 1928.

The insects infesting *Hevea brasiliensis* in Malaya include a number of termites, of which only *Coptotermes* (*Termes*) *gestroi*, Wasm., is of economic importance. It usually feeds on decaying timber, but in the absence of this it attacks living plants. Its nests are always in dead plants, tree stumps, etc., so that the ground should be kept free from such material. Though not of present economic importance, other insects that may become injurious under special conditions include *Acanthopsyche snelleni*, Heyl., *Hemithea costipunctata*, Moore, and *Platypus lepidus*, Chap.

Menzel (R.). **Verslag van den Entomoloog.** [Entomologist's Report for 1926–27.]—*Meded. Proefst. Thee* [*Buitenzorg*], no. c, pp. 24–25. Batavia, 1928.

The occurrence and biology of the Braconid, *Euphorus* [*helopeltidis*, Ferrière] parasitising *Helopeltis*, were studied in 1926 and 1927. The parasite seems to be of some practical value when present in numbers. In Deli, Sumatra, it was found in *Helopeltis* as well as in *Pachypeltis*, and in Java it was found in *Pachypeltis* infesting cinchona. An outbreak of mites, *Eriophyes carinatus*, Green, occurred on tea in Deli.

Nagamori (S.). **On an interesting Braconid Fly parasitic in a** *Tinea* **Moth.**—*Annot. zool. jap.*, x, no. 7, pp. 349–354, 1 pl. Tokyo, March 1925.

Paramesocrina tineavora, gen. et sp. n., is a parasite of the larvae of *Tinea pellionella*, L. (clothes moth) in Japan. A single parasite was usually found in the host, and very rarely two or three. Experiments have shown that this Braconid can be reared throughout the year. There are at least five generations in a year, two in the summer, and the others in autumn, winter and spring. The males emerge before the females and are probably less numerous.

Cockerell (T. D. A.). **Saving the Coconuts.**—*Science*, lxviii, no. 1771, pp. 566–567. New York, N.Y., 7th December 1927.

This is a brief account of the work done in Fiji on the biological control of *Levuana iridescens*, Beth.-Bak., and *Aspidiotus destructor*, Sign., on coconut [*cf. R.A.E.*, A, xv, 640 ; xvi, 632, etc.].

Simmonds (H. W.). **Report of the Government Entomologist.**—*Ann. Rep. Dept. Agric. Fiji 1927*, pp. 5–6. Suva, 1928.

The majority of the insects mentioned in this report have already been noticed [*R.A.E.*, A, xvi, 684]. Those not previously dealt with include the following cotton pests: *Earias fabia*, Stoll (tip worm), which caused considerable damage, the only natural enemies observed being *Polistes macaensis*, F., and an occasional predatory Pentatomid; *Aphis gossypii*, Glov., which was, however, kept in check by Coccinellids; and *Cosmophila* (*Anomis*) *flava*, F.

Anson (R. R.). **Report by the Cotton Specialist, Cotton Experiment Station, Lautoka.**—*Ann. Rep. Dept. Agric. Fiji 1927*, pp. 12–17. Suva, 1928.

The bulk of the information in this report has been noticed from another source [*R.A.E.*, A, xvi, 355]. All varieties of cotton except Sea Island were attacked by *Dacus passiflorae*, Coq., some to a very serious extent.

Pettey (F. W.). **Laboratory Studies in the Control of Codling Moth Larvae on Pears.**—*Sci. Bull.* [*Dept. Agric. S. Afr.*], no. 65, 13 pp., 5 figs. Pretoria, 1928.

In laboratory tests, 200 perfectly grown pears were selected, suspended by threads and thoroughly sprayed with a uniform application of lead arsenate as used against the codling moth [*Cydia pomonella*, L.]. Over 3,000 newly hatched larvae of *C. pomonella* were then placed on the pears, and the results noted after eight days. Very few larvae were able to produce both punctures and infestations. It was found that on unsprayed pears the greener or more immature the fruit, the less successful were the larvae in entering it. On green fruit also lead arsenate seemed to be more effective in control than on more mature pears. Many newly hatched larvae placed on unsprayed pears, however, failed to enter the fruit, and the indications are that about 30 per cent. of the larvae on sprayed pears in orchards are not necessarily killed by poison but by natural causes. Even two lead arsenate sprays at double strength (2½ lb. to 40 gals. water) did not protect the pears very effectively; about 34 per cent. out of 295 larvae entered fruit so sprayed, 13 per cent. of these surviving the poison after they had entered. The most effective spray treatment is not necessarily the one that prevents puncturing of the fruit, but the one that prevents development of the larvae into moths. The opinions of different investigators regarding the increased efficiency from the use of a casein-lime spreader are discussed; in the present experiments the value of a such a spreader remained somewhat indeterminate. The effect of varying the standard lead arsenate spray (1¼ lb. to 40 gals. water) is discussed. The author found that an increase to double strength in the spray reduced the number of larvae and consequent infestation of fruit, but produced a corresponding increase in the number of punctures.

In orchard tests, the addition of treacle to the sprays not only failed to produce better results, but caused rusty spots to form on the surface of the fruit. Lead chromate paste (6 lb. to 40 gals. water with caseinate spreader) was very much less efficient than lead arsenate at normal

strength in orchards, and neutral lead arsenate was less effective than acid lead arsenate. Even a complete spray covering will not prevent all larvae from entering the fruit, and if, as it is thought, the first mouthfuls of skin are cast aside by the larva, too great adhesiveness may make the poison stick to the skin rather than to the larva's mandibles. The general results indicate that lead arsenate is a very imperfect protection when the fruit is large and when the majority of larvae attempt to enter the sides. Every effort should be made, by thorough spraying early in the season and by supplementary methods, to prevent the development of the first generation, so as to reduce so far as possible the number of larvae hatching in the orchard when the fruit is large.

SMEE (C.). **Report of the Government Entomologist.**—*Ann. Rep. Dept. Agric. Nyasaland 1927*, pp. 19–22. Zomba, 1928.

The situation with regard to tobacco and its pests was largely dealt with in the last report [*R.A.E.*, A, xvi, 74]. Tenebrionid beetles were again troublesome in tobacco lands; some unknown factor evidently influences their abundance in different years, but the author is of opinion that keeping the ground clean for two weeks or more before planting tends to reduce infestation. Millepedes and wireworms (larvae of Tenebrionid beetles, including *Zophosis agaboides*, Gerst.) were abundant, the latter being frequently accompanied by the larvae of a Therevid fly, which are possibly predacious on them. A very light application of calcium cyanide was made to the ridges of part of an infested tobacco field; this indicated that a large quantity (800 lb. or more to the acre) would be of value, but too expensive.

Tea was remarkably free from pests. *Helopeltis bergrothi*, Reut., was scarce; the indications are that it is favoured by a wet January followed by months of unusual rainfall. Observations of *Dicasticus mlanjensis*, Mshl. (tea leaf weevil) show the females to be very prolific, one producing 1,823 eggs in 47 days and another 2,500 eggs during 6 months. These are deposited in batches of about 60 under the folded tip of a leaf or between two leaves at the top of a bush, and hatch in 7–10 days at the beginning of the season and in 20–30 days later on. They are parasitised by an undetermined Chalcid. A small black weevil, *Systates* [*smeei*, Mshl.], has similar habits but is not numerous. The adults and eggs of both of these weevils could easily be hand collected. The Capsid, *Callicratides rama*, Kirby, has been observed to oviposit in tea shoots, but would not feed on the leaves if bean flowers were available. The use of beans as a cover crop among tea raises the question whether any of the many insects that feed on them will attack parts of the tea bush. The two weevils mentioned above undoubtedly did most damage to tea after a cover crop of beans had been removed. *Anaplocnemis curvipes*, F., is much attracted to beans, and will also attack tea shoots, causing wilting of the tips. Termites do considerable damage to young plants, attacking even the healthy ones. Improved drainage would undoubtedly render conditions less favourable to them. Calcium cyanide could not be used at sufficient strength to destroy or drive them away without being detrimental to the tea bushes. The species in question make no noticeable nest, but emerge from the soil close to the collar of the plant and climb up the main stem under an earthen run-way until the stem or a lateral branch is entered and completely hollowed out so that the upper part falls down. Calcium

cyanide is very efficient in eliminating termites from the brickwork of houses.

On coffee, wherever the measures advocated in the last report against *Anthores leuconotus*, Pasc. (white stem-borer) have been definitely carried out, this beetle has been reduced to minor importance. *Apate indistincta*, Murray (black stem-borer), recorded in the previous report as *Apate* sp., again appeared sporadically. *Dirphya nigricornis*, Ol. (orange stem-borer), which was referred to in the previous report as *Dirphya* sp., oviposits at the summit of the bush, and the grub bores into the middle of the stem and descends down the centre to the tip of the tap-root. The grub is in the plant for a year, making in its progress a series of holes to the exterior from which frass is extruded. Infested plants in every case investigated were found to have been badly planted, with the tap-root bent up almost at a right-angle. The beetles may be collected during the early rains, but, except for the holes mentioned above, there is no indication of attack until dry weather sets in, when the leaves turn yellow and droop, by which time the grub is far down the stem. The adult emerges at the beginning of the rains from a circular hole in the collar of the bush just below ground level. The necessity for concerted action against these borers, particularly *Anthores*, is obvious, and abandoned or neglected coffee gardens are a great source of re-infestation. The grasshopper recorded on coffee in the previous report as *Aularches* sp. is *Phymateus viridipes*, St.

A sudden, isolated outbreak of the weevil, *Systates sexspinosus*, Mshl., occurred on a small area of maize, but it is unlikely to be more than an occasional maize pest. Dusting with Paris green and flour was a successful remedy ; calcium cyanide dusted into the leaf sheaths killed the plants as well as the insects. An attack of *Icerya seychellarum*, Westw., on roses was almost completely controlled by the Coccinellid, *Novius obscurus*, Wse.

Mellor (J. E. M.). **Wax Moths** (*Galleria mellonella*, **L. and** *Achroia grisella*, **Fb.**).—*Leafl. Plant Prot. Sect. Minist. Agric. Egypt*, no. 2, 6 pp., 5 figs. Cairo, 1928.

A brief popular account is given of the habits and control of *Galleria mellonella*, L., and *Achroia grisella*, F., two important pests of apiaries in Egypt.

Claude-Joseph (F.). **Recherches biologiques sur les prédateurs du Chili.**—*Ann. Sci. nat., Zool.*, (2) xi, no. 1, pp. 67–207, 68 figs. Paris, April 1928.

An account is given of the biology of numerous Chilean Sphegid wasps, with some morphological notes. The nests are described with details of the methods of provisioning them with other insects.

Van Leeuwen (E. R.), Anderson (O. G.) & van der Meulen (P. A.). **Some Phases of the Japanese Beetle Insecticide Investigations.**—*J. Econ. Ent.*, xxi, no. 6, pp. 805–813, 2 pls., 2 refs. Geneva, N.Y., December 1928.

This paper discusses the present status of the control of *Popillia japonica*, Newm. (Japanese beetle) by means of insecticides in New

Jersey and describes several of the more valuable methods for the protection of plants and the destruction of the beetles. Various factors influencing the results of insecticide experiments are discussed, and data are given to show that certain non-toxic materials, such as chalk and china-clay, are as effective in repelling beetles as lead arsenate, indicating that other factors besides toxicity are responsible for the repellent qualities of lead arasenate sprays. Progress is reported in connection with the difficulties encountered in attracting the beetles to poisoned foliage and in persuading them to eat the poison. Geraniol attracted the beetles when included in lead arsenate sprays, and the addition of a solution of refined sugar induced them to attack foliage sprayed with lead arsenate in preference to unsprayed foliage. Other methods of control that have also been improved include the use of contact sprays [*R.A.E.*, A, xiv, 656], which proved more effective when preceded by an application of geraniol to attract large numbers of beetles. This attractant is best applied when the beetles are most active, generally under conditions of bright sunshine and high temperature, which should be at least 80° F. Other factors favourable to the use of geraniol are a relative humidity of between 40 and 70 per cent., a slight breeze and a low vapour pressure. Many beetles were caught in traps baited with a mixture consisting of 20 U.S. gals. apple juice, 2 lb. raisins, 20 lb. sugar and 18 yeast cakes. The mixture was allowed to ferment for a fortnight before being put into 2 U.S. quart galvanised pans, two-thirds filled and hung in infested peach trees.

It appears from the results hitherto secured that any material used in cases of heavy infestation must serve either for the protection of the plant by repelling the beetles, or for killing the beetles without regard to protection, no method having been observed whereby both purposes are served simultaneously.

As *P. japonica* continues to spread, new problems of control are arising. In eastern Pennsylvania and southern New Jersey the beetles have been numerous on maize, attacking the tassel, leaves and silk. Injury to blackberries and raspberries that has occurred in New Jersey would be difficult to control, because the ripening fruit is especially attacked.

FLEMING (W. E.). **Soil Insecticides for the Japanese Beetle.**—*J. Econ. Ent.*, xxi, no. 6, pp. 813–818. Geneva, N.Y., December 1928.

A brief summary is given of the materials that have been tested to determine their effectiveness for destroying the Japanese beetle [*Popillia japonica*, Newm.] in the soil about the roots of nursery plants.

If complete fumigation within a few hours is desired, carbon bisulphide, which at a concentration of 4 parts to 100,000 parts of air is lethal to the larvae and eggs within 24 hours at 80° F., is possibly the most effective and reliable compound that can be employed, but where treatment is to be prolonged over several days or weeks, it might be preferable to use a compound of low vapour pressure, such as naphthalene, paradichlorobenzene or paratoluidine, the vapour of which can be maintained at a killing concentration for a much longer period.

Carbon bisulphide in the form of a dilute emulsion proved toxic to the soil-infesting stages of *P. japonica* at concentrations varying from 0·01 per cent. for the eggs to 0·04 per cent. for the pupae, the most

satisfactory results being secured at a temperature of 65–70° F., with the treatment prolonged for 24 hours. A list is given of chemicals found to be more toxic in dilute emulsions than carbon bisulphide. Tests showed that a larger volume of toxic solution can be passed through the infested mass, and a greater concentration obtained, by pouring the solution upon the surface of the soil and allowing it to percolate through it than by submerging the soil in the solution. Though several of the solutions gave satisfactory results, carbon bisulphide emulsion was found to be equally effective and much less expensive.

As the result of tests begun 3 years ago to determine which organic compounds that are solid under ordinary conditions could be mixed with the soil to destroy the beetle, a table is given showing approximately the minimum concentration and minimum period of time necessary to kill the insects with each of the 47 compounds found to be the most toxic.

In general, uniformly good results can be expected only in soils in which the proper dispersion of the toxic agent is assured, it being of equal importance to have the soil in suitable condition and to choose the proper insecticide.

Fleming (W. E.) & Baker (F. E.). **Hot Water as an Insecticide for the Japanese Beetle in the Roots of Nursery Stock.**—*J. Econ. Ent.*, xxi, no. 6, pp. 818–822. Geneva, N.Y., December 1928.

Experiments carried on since the autumn of 1926 in killing the eggs, larvae, pre-pupae, pupae and adults of *Popillia japonica*, Newm. (Japanese beetle) by submerging them in hot water indicated that 112° F. is the lowest temperature that will give dependable results within a practical period of time. When first found in the soil in July, a submersion for 55 minutes was found sufficient to kill the eggs without soil, but there is a gradual increase in resistance as the season progresses, a treatment of 60 minutes being required after 1st August. First and second instar larvae can be killed at any time by submerging them in water at 112° F. for 30 minutes, but third instar larvae, which are found in the soil during almost the whole year, though they can be killed in August and September as readily as other larval instars, become more resistant after the middle of October. This resistance gradually increases until in March it is necessary to treat them for 55 minutes. When the ground becomes warmer in the spring, their resistance again decreases until in June they can be killed by a treatment of 20 minutes. An exposure of 40 minutes is required to kill the pre-pupae, which are more resistant than the larvae during late May and June, the period of their greatest abundance. The pupae, which are most numerous in June and early July, are the most resistant, a submergence for 60 minutes being necessary to ensure their destruction. The adults, which spend a considerable part of their life in the soil, are the most easily killed of all. At their first appearance, when they are most resistant, they are killed in 20 minutes. All living forms of the beetle may be destroyed in the soil by keeping a previously submerged mass at 112° F. for a period of time necessary to kill the most resistant stage present. The pre-heating necessary to raise the temperature of the mass of soil to 112° F. weakens the beetle and renders it more susceptible to treatment.

Allen (H. W.) & Jaynes (H. A.). **Progress with the imported Parasites of the Japanese Beetle during 1927.**—*J. Econ. Ent.*, xxi, no. 6, pp. 823–832, 1 fig., 1 ref. Geneva, N.Y., December 1928.

This paper, which is the fourth of a series [*R.A.E.*, A, xii, 172; xiii, 338; xv, 443], deals with the progress effected in the work of introducing parasites of *Popillia japonica*, Newm., into New Jersey in 1927. The distribution of the Tachinid, *Centeter cinerea*, Ald., has increased to 75 square miles. At the beginning of beetle emergence, parasitism was as high as 10 per cent., but dropped very rapidly as the beetles became more numerous. Importations from Japan of parasitised beetles were renewed for liberation in 1928, with a view to extending the distribution of the parasite northwards, in which direction it is expected to thrive better. *Ochromeigenia ormioides*, Towns., has not yet been recovered, but both *Prosena siberita*, F., and *Dexia ventralis*, Ald., were found in the field, and further liberations were made of all three parasites.

Tiphia popilliavora, Roh., has increased rapidly from the small beginnings previously reported, the adults being found at 3 of the 4 colonisation points and in great abundance on the blossom of wild carrot at the centre of the largest of these. Definite establishment of this species has been obtained from very small numbers released. Of 7,707 cocoons of a Chinese strain of *T. popilliavora*, imported in 1925–26, only a few that were forced emerged, but 327 adults emerged during the summer of 1928 from a subsequent shipment of 7,910 cocoons received in 1926–27, which had passed through their second winter. A two-year cycle is thus indicated in New Jersey for a strain having, so far as is known, only one in its native habitat; the Japanese strain, with which it is morphologically identical, has only a single-year cycle, both in New Jersey and in Japan. The Chinese strain, 232 mated females of which were liberated between 12th October and 22nd November, is exceptionally hardy in both the adult and cocoon stages, and parasitises the larvae of *P. japonica* as readily as the Japanese strain. From 830 cocoons of a Korean strain of the same species received early in 1927, 45 females, mated in the insectary, were released. This strain, which also readily parasitises the larvae of *P. japonica*, has a one-year cycle under insectary conditions in New Jersey, but emerges somewhat later than the established Japanese strain.

Although no adults of *Tiphia vernalis*, Roh., large numbers of which were released in 1926, were recovered in the field, living pupae from the parasitised grubs released were found as late as 7th June 1927, and a cocoon from which an adult had emerged was also unearthed. A Japanese species of *Tiphia*, as yet undetermined [xv, 444], has been liberated in large numbers, and importations of two undetermined Indian species have been continued.

Shipments including 387 adults of *Tiphia vernalis*, 1,140 puparia of *Dexia ventralis* and 125 females of *T. popilliavora* have been forwarded to Long Island for trial against *Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow.

A brief review is given of the work accomplished since 1920. The number of beneficial insects released, which for several years past has varied between 6,000 and 10,000, increased to 30,694 in 1927. The largest liberations were of *Tiphia vernalis*, *Centeter cinerea* and *Scolia manilae*, Ashm. Importations of *C. cinerea* exceed all others combined

with a total of 360,000. In the case of *T. vernalis* and one of the unidentified species of *Tiphia*, the number of individuals available for release has been increased by using the imported females for the production of eggs, thus allowing more to be liberated than the total number received.

YOTHERS (M. A.). **Observations on the Snout Beetle, *Evotus naso*, Lec., on Apple Trees at Yakima, Washington.**—*J. Econ. Ent.*, xxi, no. 6, pp. 832–836, 1 fig., 2 refs. Geneva, N.Y., December 1928.

Adults of *Evotus naso*, Lec., hitherto believed to feed on sage (*Artemisia*), were recorded for the first time as feeding on leaf buds of apple at Yakima, Washington, in late April and early May 1925. Preliminary observations showed that, under artificial conditions, these weevils will feed on the leaves of apple, peach, pear, and some other plants. The eggs are laid in groups of 10–26, each female probably laying about 100 eggs in all. Females under observation from 30th April until 2nd May deposited eggs within leaves in cages ; this has not been observed in the orchard. Apparently the oviposition period lasts from the end of April until early July. The incubation period lasts from 18 to 30 days. One female lived 75 days and had probably been adult for some time before observations were begun, but males died quickly in the laboratory. All attempts to rear the larvae in small tin boxes filled with earth and fibrous roots failed.

YOTHERS (M. A.). **Are Codling Moths attracted to Lights?**—*J. Econ. Ent.*, xxi, no. 6, pp. 836–842, 1 ref. Geneva, N.Y., December 1928.

Contrary to the opinion held for many years, tests carried out in 1926 and 1927 have shown that *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) is readily attracted to lights under normal orchard conditions. In a closed store-room where moth emergence from apple boxes had been considerably delayed by low temperature, a test indicated that a 25-watt carbon electric light had a greater attraction for the moths than apple ferment baits. A further test showed that moths were attracted about equally by lights beneath which a can of water was placed, and by those associated with bait. Of a total of 4,006 moths captured during these tests, 59·16 per cent. were females, or about the same proportion of the sexes as among moths captured in trap baits in the orchard. In a subsequent test in an orchard in 1926, only a few moths were attracted to a light trap. In a more comprehensive test in 1927, however, the moths were readily attracted to varying intensities and colours of light in light traps under normal orchard conditions. The addition of baits to the traps failed to increase the catch. Although the number of moths captured probably does not vary uniformly in proportion to the intensity of the light, there appears to be a tendency in that direction, 5 moths being caught on one occasion with a 10-watt light as compared with 50 moths with a 60-watt light. The moths apparently react less to lights (as is also the case with baits) when the temperature falls below a certain point, a drop from 1,000 moths to 11 in the bait traps coinciding with a fall from 78° F. to 56° F. in the temperature and significantly low captures in the light

traps. The number of moths caught in two light traps during the period of greatest abundance and activity of the moth (3rd-25th August) averaged 32·68 a day. It is not suggested that these traps, although definitely attractive to the moths, are of any considerable control value.

Peterson (A.) & Haeussler (G. J.). **Some Observations on the Number of larval Instars of the Oriental Peach Moth,** *Laspeyresia molesta,* **Busck.**—*J. Econ. Ent.*, xxi, no. 6, pp. 843–852, 1 graph, 1 ref. Geneva, N.Y., December 1928.

The following is taken from the authors' summary: By applying Dyar's ideas that the width of the head capsule of a Lepidopterous larva is more or less constant for any instar of a given species and that successive larval instars show a more or less regular geometric progression in the growth of the head capsules, larvae of *Cydia* (*Laspeyresia*) *molesta,* Busck (oriental peach-moth) are found to have four or five instars. As a rule, rapid growth produces four instars and slow growth five instars.

Rapidity of larval growth is dependent upon at least two factors, temperature and food. Larvae develop somewhat faster in peaches than in apples under insectary conditions. The rate of development of individual larvae in a given food varies considerably.

Holloway (T. E.) & Haley (W. E.). **A cooperative Estimate of the Loss caused by the Sugar-cane Moth Borer.**—*J. Econ. Ent.*, xxi, no. 6, pp. 852–854, 3 refs. Geneva, N.Y., December 1928.

An account is given of the method of estimating the loss caused by *Diatraea saccharalis,* F. (sugar-cane moth borer) to the Louisiana sugar crop, followed by the Bureau of Entomology and the Bureau of Agricultural Economics, U.S. Department of Agriculture, according to which a 100 per cent. infestation, *i.e.*, one in which every stalk is bored, represents the loss of one-third of the crop, and similarly a 10 per cent. infestation implies one-tenth of this loss. The crop-losses in 1922 and 1923 were estimated at 17 and 23 per cent.

Griswold (G. H.). **A new Leaf Miner injurious to Larkspur** (*Phytomyza delphiniae,* **Frost**).—*J. Econ. Ent.*, xxi, no. 6, pp. 855–857, 1 ref. Geneva, N.Y., December 1928.

Both larvae and adults of *Phytomyza delphiniae,* Frost (larkspur leaf-miner) injure the foliage of perennial larkspur (*Delphinium cultorum*) at Ithaca, New York. The larvae mine into the leaves, a number of larvae usually feeding in the same mine, and a single leaf may contain several unconnected mines. The adults feed on the lower surface of the leaves, their feeding punctures running through to the upper epidermis. In one case 45 of these punctures, the edges of which turn brown and sometimes coalesce, were found in less than a square centimetre of leaf surface. The egg is laid in the puncture made by the adult, and the larva begins to mine immediately after hatching, only leaving the mine to pupate. Some of the puparia appear to adhere to the leaves, but others drop to the ground. The stages of the insect are described. The lengths of the egg and larval stages have not been determined, but the pupal stage was found to last about 16 days

at midsummer, growing longer towards the end of the summer and being prolonged to one month in October. There are several generations a year, and the second growth, which develops in late summer and early autumn, is also attacked, the larvae being found in mines until 27th October in 1927. Hibernation probably takes place in the pupal stage on the surface of the ground. Two Hymenopterous parasites, *Cyrtogaster liqueatus*, Ashm., and an undescribed species of *Opius*, have been reared from the pupae. Control can be effected by removing and burning all infested leaves before the larvae have left the mines, but experiments will be made with a view to discovering an insecticide that will reach the young larvae in their mines without injuring the foliage.

Bryson (H. R.). **Hibernation of Chinch Bugs in Sudan Grass.**—*J. Econ. Ent.*, xxi, no. 6, pp. 857–863, 3 refs. Geneva, N.Y., December 1928.

Studies to determine the efficiency of Sudan grass (*Sorghum vulgare sudanense*), which is increasingly cultivated as a forage crop in Kansas, as hibernation quarters for *Blissus leucopterus*, Say, which were begun in the autumn of 1917, have been carried out at intervals up to 1927. Although not so suitable as native bunch grass, tall, uncut bunches of Sudan grass that had not been too closely pastured and had a dense growth of leaves at the base were found to furnish suitable hibernating quarters for *B. leucopterus*. The observations showed a maximum of 529 live chinch bugs in any one clump during the hibernating period, while the average number was 21·1 to the bunch.

Henderson (C. F.). **Exploration in the Argentine Republic for Parasites of the Beet Leafhopper, *Eutettix tenellus* (Baker).**—*J. Econ. Ent.*, xxi, no. 6, pp. 863–871, 1 map, 6 refs. Geneva, N.Y., December 1928.

In view of the statement by Boncquet [*cf. R.A.E.*, A, xvi, 672] that *Eutettix tenella*, Baker, occurs in Argentina in conjunction with curly-top of sugar-beet, which has since been shown to be transmitted by *Agallia sticticollis*, Stål, investigations were conducted during several months in a number of provinces in an attempt to discover parasites of the leafhopper. Although beet having typical curly-top foliage symptoms was found in most of these localities and favourable food-plants growing there were swept, no trace of *E. tenella* was found.

Knight (P.). **The Development and present Status of Entomological Courses in American Colleges and Universities.**—*J. Econ. Ent.*, xxi, no. 6, pp. 871–877. Geneva, N.Y., December 1928.

The following is taken from the author's summary: This is the first of three papers on the teaching of elementary entomology, and will serve as an introduction to the succeeding publications. It traces the history of the teaching of the subject in the United States and gives a fairly comprehensive idea of current academic work. That the historical information and data on the number of courses is incomplete has been shown by a recent paper [*R.A.E.*, A, xvi, 322], which should be consulted together with the present one.

Driggers (B. F.). **Effect of early Summer and late Summer White Oil and Nicotine Sulphate Sprays on the Number of Eggs of the European Red Mite overwintering on Peach Trees.**—*J. Econ. Ent.*, xxi, no. 6, pp. 878–882. Geneva, N.Y., December 1928.

The data presented in this paper show the effect on the number of overwintering eggs of the European red mite [*Paratetranychus pilosus*, C. & F.] of certain sprays applied to peaches in New Jersey in the summer of 1927 against the oriental fruit moth [*Cydia molesta*, Busck]. Five applications of nicotine sulphate, 1 : 800, or 1 per cent. white oil emulsion on peaches in May and June failed to prevent the deposition of a number of eggs, and three applications in August of ground tobacco dust produced no reduction in the number of eggs overwintering. Four applications in August of nicotine sulphate, 1 : 800, gave a reduction of 29 per cent., and 1 per cent. oil emulsion applied four times in August gave a reduction of 98·9 per cent. in the number of overwintering eggs. Injury resulting in slight shedding of fruit and foliage was caused by the application of the oil sprays.

Jarvis (G. L.). **Disinfecting Combs.**—*J. Econ. Ent.*, xxi, no. 6, pp. 887–889. Geneva, N.Y., December 1928.

The following is the author's abstract of this paper: Alcohol-formalin and water-formalin are not always effective for American foulbrood in cases where there are massed spores. Treatment of brood combs may mean harbouring or spreading the disease. There is no danger of infection from dry super combs. Wet super combs that do not contain scales may be disinfected by immersing in hot water for 24 hours.

Fulton (B. B.). **Some Temperature Relations of *Melanotus* (Coleoptera, Elateridae).**—*J. Econ. Ent.*, xxi, no. 6, pp. 889–897, 1 chart, 2 refs. Geneva, N.Y., December 1928.

Temperature experiments with adults of *Melanotus communis*, Gyll., the common habitat of which was found to be shade trees near grass land, showed that they cannot live long on the surface of the ground on hot days, an exposure to sunlight for 1½ minutes proving fatal to them on a day when the maximum recorded temperature was 92° F. in the shade. Exposure in an oven caused death in 25 minutes at 45° C. [113° F.] and in 3½ minutes at 49° C. [120·2° F.]. Further experiments to determine the temperature voluntarily selected by the beetles indicated that their choice of temperature is much below the usual maximum in open fields in summer in North Carolina. Their optimum range is from 20 to 30° C. [68–86° F.], with a theoretical optimum, as indicated by their selection of temperature in a gradient, at about 27–28° C. [81–82° F.]. Above 30° C. [86° F.], the heat becomes increasingly intolerable to them, and they make violent efforts to escape it. Below 20° C. [68° F.], the temperature does not influence their movements so strongly, and a slight decrease in light will induce them to enter colder situations. Both reduced light and lower temperatures probably induce greater activity in the beetles, which are naturally active at night, when it is presumed that they leave the trees in which they find shelter during the day and fly to the fields for oviposition.

The larvae of *M. communis* are more resistant to heat than the adults, but they do not voluntarily seek higher temperatures. No marked preference was shown by the larvae for any limited range of temperature between 17 and 29° C. [62·6–84·2° F.], but a more accurate determination of the optimum temperature may be possible if an apparatus can be devised to permit complete submergence in the soil without making the recording of data too difficult. Data from these experiments are not sufficient to explain fully the influence of temperature on the seasonal movement of wireworms, in the determination of which soil moisture is doubtless an equal or greater factor.

Robinson (W.). **Water Conservation in Insects.**—*J. Econ. Ent.*, xxi, no. 6, pp. 897–902, 2 graphs. Geneva, N.Y., December 1928.

Most of the information contained in this paper has already been noticed [*R.A.E.*, A, xvi, 504; xvii, 41]. A list is also given of a number of insects and their food, differing greatly in water content, the relative proportions of the water content of the insects and of their food being indicated.

McIndoo (N. E.). **Responses of Insects to Smell and Taste and their Value in Control.**—*J. Econ. Ent.*, xxi, no. 6, pp. 903–913, 51 refs. Geneva, N.Y., December 1928.

The information contained in this review of the literature on various aspects of chemotropism in insects, which is widely scattered and has not previously been collated, has been gathered from very numerous sources, some of the chief of which are cited.

Morgan (A. C.) & Crumb (S. E.). **Notes on the Chemotropic Responses of certain Insects.**—*J. Econ. Ent.*, xxi, no. 6, pp. 913–920, 3 refs. Geneva, N.Y., December 1928.

The following is taken from the authors' summary: This paper discusses very briefly some of the studies of insect chemotropism conducted over a period of 14 years at Clarkesville, Tennessee. During the period of investigation many different chemicals and substances were tested, and the observations and experiments covered insects belonging to several orders. Though in most instances the results were only indicative, experiments showed that adults of *Protoparce* spp. (tobacco hornworms) are strongly attracted to amyl salicylate [*cf. R.A.E.*, A, xvi, 400].

McClean (H. C.) & Weber (A. L.). **Influence of Spray Practices on arsenical Residues.**—*J. Econ. Ent.*, xxi, no. 6, pp. 921–928, 1 fig., 2 refs. Geneva, N.Y., December 1928.

Experiments conducted in New Jersey during a season in which the total rainfall was 26·92 inches, or 4·99 inches above normal, show that heavy applications of lead arsenate may be made up to 1st July to varieties of apples maturing in September and October without seriously exceeding the spray residue tolerance, which for 1928 had been decreased 60 per cent. from that fixed for the 1927 crop. After heavy sprays in

June no further applications can be made without surpassing the new tolerance (0·01 gr. AS_2O_3 to 1 lb. fruit). Apples that had received a total of 1·28 lb. lead arsenate to the tree in 5 applications, including 2 applications in June of 0·24 lb. and 0·31 lb., contained residues at harvest time amounting to 0·012 gr. AS_2O_3 to the pound. In a case in which 1·07 lb. lead arsenate was applied in 7 treatments, the last of which was made on 10th August, the fruit was found to contain 0·031 gr. AS_2O_3 to the pound. The smallness of residues left by June sprays, apart from removal by washing, appears to be due to the fact that they are applied to a relatively small apple, the ratio between the weights of the arsenic trioxide and of the apple becoming greater with the growth of the fruit. Since small apples ($2\frac{1}{4}$–$2\frac{1}{2}$ ins.) were found to contain 25 per cent. more residues than large ones ($2\frac{3}{4}$–$3\frac{1}{2}$ ins.), orchard practices fostering the growth of large apples will tend to decrease the residue content. The heaviest residues are invariably found on fruit on the lower limbs of the trees, owing to the dripping of the spray at the time of application and subsequent gradual washing from the higher branches.

Only a trace of arsenical residues was detected on dusted fruit at the time of picking, and apples sprayed up to 1st July and subsequently dusted also showed very low residues at harvest. When the last spray application made consists of only 10 per cent. lead arsenate paste and a small amount of casein-lime in addition to the water, little apparent residue will be left although a very high arsenical residue may be present, a slight oiliness being the only visible indication of the thin film formed around the fruit by the lead arsenate in this case.

It is evident from these experiments that, if treatment must be applied in late July and August, it will be necessary either to find a cheap substitute for lead arsenate that will leave no extensive objectionable residues, to use arsenical dusts, or to remove chemically the arsenic from the fruit when harvested. Mechanical cleaners have been shown to be inadequate in removing spray residues, but chemical methods appear promising, though their effect on the keeping quality of the fruit has yet to be determined.

COWAN (F. T.). **Use of Arsenites in the Control of Mormon Crickets.** — *J. Econ. Ent.*, xxi, no. 6, pp. 928–932. Geneva, N.Y., December 1928.

The information contained in this paper on experiments carried out in 1926 against the Mormon cricket [*Anabrus simplex*, Hald.] in Montana has already been noticed [*R.A.E.*, A, xvi, 403]. Experiments in the spring of 1927, in which field tests were made with various crops, showed that from 75 to 90 per cent. mortality of the crickets could be secured by the application of a dust of sodium arsenite and lime, 1 : 4, at the rate of 5 lb. to the acre. No scorching was observed on wheat, but a little was caused on lucerne where dusting had been followed by rain, or when the vegetation was wet with dew at the time of application. Equally good results were secured at less cost by the application of a calcium arsenite and lime, 1 : 3, at the rate of 8 lb. to the acre. Treatment should be applied early in the spring, just after all the young crickets have hatched and before they move far from the hatching grounds, as they are more concentrated at this stage. Early morning or late evening, when the crickets gather in compact

groups, are the best times for dusting. A good rotary dusting machine, capable of being mounted on a saddle horse or light wagon, should be used. In western Montana in 1927 a crop valued at £25,000-£30,000 was saved by the expenditure of £1,800 on 9,000 lb. calcium arsenite, 2,000 lb. sodium arsenite and the corresponding quantities of lime, with which practically 100 per cent. control of the crickets was secured.

RILEY (H. K.). **A Method of volatilizing Carbon Bisulphide for Soil Fumigation.**—*J. Econ. Ent.*, xxi, no. 6, pp. 932–933, 1 pl. Geneva, N.Y., December 1928.

In the course of soil fumigation tests for the control of *Scutigerella immaculata*, Newp. (greenhouse centipede) in greenhouses at Indiana, carbon bisulphide was volatilised by being placed in a 30 U.S. gal. steel oil drum, through which steam was passed under 50 lb. pressure. The drum was placed on a platform in a horizontal position, with a small opening in the end fitted with a $\frac{3}{4}$-inch pipe and globe valve for the entrance of the steam. The plot treated was a ground bench 11 ft. wide and 175 ft. long, equipped with six 4-inch tiles previously installed for steam sterilisation. The gases produced were forced into these tiles, which extended the length of the bed at a depth of about 16 inches, through a 2-inch tube by which each tile in succession was connected with the tank. The carbon bisulphide was poured into the tank at the rate of 15 lb. for each tile and was volatilised rapidly, only a few minutes being required to drive the whole charge into the soil. After this steam was forced into each tile for about 15 minutes to ensure even distribution of the gas.. No living *Scutigerella* or other soil infesting forms were found in the soil a month after treatment, and the plants cultivated in it showed unusually vigorous growth.

LANE (M. C.) & SHIRCK (F. H.). **A Soil Sifter for subterranean Insect Investigations** —*J. Econ. Ent.*, xxi, no. 6, pp. 934–936, 2 pls. Geneva, N.Y . December 1928.

A description is given of a soil-sifting machine intended to facilitate investigations of subterranean insects, particularly wireworms. The soil is passed through screens of meshes of increasing fineness. A second screen of 12 meshes to the inch is sufficient for the separation of the larger larvae, and the smaller larvae and eggs of most of the injurious Elaterids indigenous to the north-western Pacific area of the United States can be separated from the soil by a 40-mesh screen.

WHITCOMB (W. D.). **A new beneficial Beetle in Massachusetts.**—*J. Econ. Ent.*, xxi, no. 6, pp. 937–938. Geneva, N.Y., December 1928.

Adults of *Cantharis andersoni*, Frost, a recently determined Telephorid beetle closely resembling *C. rotundicollis*, Say, and which has increased rapidly in eastern Massachusetts since 1920, were observed to feed in the laboratory on most Aphids common in the locality and on various small Coleopterous and Lepidopterous larvae. The large number of these beetles present during the last two years has had a noticeable effect in counteracting the ravages of injurious Aphids.

Cockerell (T. D. A.). **Distribution of** *Phthorimaea operculella*, **Zeller.**—*J. Econ. Ent.*, xxi, no. 6, p. 938. Geneva, N.Y., December 1928.

The collection of specimens of *Phthorimaea operculella*, Zell., at the lights of ships standing off Samarang, Java, and Townsville, Queensland, in March 1928 is recorded as showing the tendency of this moth to fly long distances. The moths were not noticed while at sea, and as they were in company with various insects obviously from the shore, it was not thought they they had originated from potatoes on board.

Driggers (B. F.). **Talc and Mica Dust as a Control of Lepidopterous Larvae.**—*J. Econ. Ent.*, xxi, no. 6, pp. 938–939. Geneva, N.Y., December 1928.

Laboratory experiments with larvae of the oriental peach moth [*Cydia molesta*, Busck] carried out in New Jersey in 1928, in which finely ground talc or mica dust was used as a mechanical barrier to prevent their entry into the twigs and fruit, indicate that these dusts are likely to prove of value against the young larvae of insects that lay their eggs in such a position that the larvae are forced to crawl over the surface of the plant to reach a point of entry. In insectary tests, over 90 per cent. of the recently hatched larvae of *C. molesta* were killed by mica dust before being able to enter the fruit, and even better results were secured with talc dust. Limited tests with both dusts against newly-hatched larvae of the codling moth [*C. pomonella*, L.] showed them to be similarly affected.

Lipp (J. W.). **A Suggestion for a possible Application of Ovipositional Chemotropism.**—*J. Econ. Ent.*, xxi, no. 6, p. 939. Geneva, N.Y., December 1928.

Tests in which 50 males and 50 females of a soil-infesting insect were placed in a wire cage over grass, in one corner of which a small cup containing a chemical was placed, indicated that there was a decided preference for the vicinity of the chemical as a place for oviposition. These tests suggest the possibility of artificially limiting the area on which eggs are laid.

Hamlin (J. C.). *Copidryas cosyra*, **Druce, an Enemy of Cactus on the West Coast of Mexico.**—*J. Econ. Ent.*, xxi, no. 6, pp. 939–940, 1 ref. Geneva, N.Y., December 1928.

Larvae of *Copidryas cosyra*, Druce, were found locally feeding externally upon a species of *Opuntia* of the *imbricata* group in Mexico in 1922. This moth has also been recorded from Arizona.

List (G. M.), Daniels (L. B.) & Bjurman (C. J.). **Sulphur in the Control of Mites in Parasite Breeding Laboratories.**—*J. Econ. Ent.*, xxi, no. 6, p. 940. Geneva, N.Y., December 1928.

The work of breeding *Trichogramma minutum*, Riley, in the eggs of *Sitotroga cerealella*, Ol., has been seriously interfered with by mites (*Pediculoides ventricosus*, Newp., and a Gamasid, *Seius* sp.) that have destroyed *S. cerealella* in the laboratories. The Gamasid,which attacks

the eggs, did more damage at first, but later *P. ventricosus*, which feeds upon all stages of the grain moth, became the more serious. A marked decrease in the numbers of both species of mites has been secured by the application of dusting sulphur to the bins and grain, and the egg production of *S. cerealella*, which had dropped from 100,000 in April to 1,000 during part of July when the mites were most numerous, rose again after treatment on 19th July to 15,000 or 20,000 in August. In repeated tests all the Gamasid mites were killed when they came in contact with the sulphur immediately after hatching, but no definite proof of the effectiveness of this material on *P. ventricosus* has yet been obtained. The sulphur does not appear to be injurious to the adults or larvae of *S. cerealella*.

ANNAND (P. N.). **A Contribution toward a Monograph of the Adelginae (Phylloxeridae) of North America.**—*Stanford Univ. Pub. Biol. Sci.*, vi, no. 1, 146 pp., 31 figs., 161 refs. Stanford University, Cal., 1928. Price, paper $2.00; cloth, $2.75.

The general morphology and biology of the subfamily CHERMESINAE (ADELGINAE) are discussed, and a key is given to the two subfamilies of the family PHYLLOXERIDAE and to the species of CHERMESINAE. The 20 species occurring in North America are described, including 7 new ones, and in many cases notes are given on their life-history, distribution, coniferous food-plants, the type of injury caused, and the methods employed for their control.

WALLACE (F. N.) & others. **Report of the Division of Entomology.**—*9th Ann. Rep. Dept. Conservation Indiana 1926–27*, pp. 23–71. Indianapolis, Ind., 1928.

The situation regarding the European corn borer [*Pyrausta nubilalis*, Hb.] in Indiana and the measures for its control are discussed. Two of its parasites, *Pimpla* (*Exeristes*) *roborator*, F., and *Microbracon brevicornis*, Wesm., have been released.

Insect pests occurring in Indiana and not mentioned in the last two reports [*R.A.E.*, A, xv, 186, 402] include: *Chionaspis pinifoliae*, Fitch (pine scale), an important pest of pines and spruces in nurseries; *Lepidosaphes ulmi*, L. (oyster shell scale), a serious pest of ornamental plants and shade trees, against which dry lime-sulphur (1 lb. to 2 U.S. gals. water) and oil sprays (1 gal. to 10 gals. water) applied early in March gave excellent results; *C. salicis-nigrae*, Walsh (willow scale), on golden willow in nurseries; *Aphis pomi*, DeG. (apple aphis) and *Eriosoma lanigerum*, Hausm. (woolly apple aphis), which were abundant on apple stock and in orchards; *Anuraphis viburnicola*, Gillette (snowball aphis), causing serious malformation of *Viburnum*; *Ancylis comptana*, Frohlich (strawberry leaf roller) and *Tyloderma fragariae*, Riley (strawberry crown borer), on strawberries; *Monophadnus* (*Monophadnoides*) *rubi*, Harris (raspberry sawfly), on raspberries; *Myzus cerasi*, F. (black cherry aphis), on cherry; *Hysteroneura setariae*, Thos. (rusty plum aphis), on plum trees; *Periphyllus lyropictus*, Kessler (Norway maple aphis), which was extremely abundant on Norway maples [*Acer platanoides*], defoliating the trees in many cases, but was eventually controlled by natural enemies, including the Coccinellids, *Coccinella novemnotata*, Hbst., *Cycloneda* (*Coccinella*) *sanguinea*, L., *Hippodamia convergens*, Guér., and *H. parenthesis*, Say; *Papaipema nitela*, Gn.

(common stalk borer), which was an important pest of field crops; *Heliothis obsoleta*, F. (corn ear worm), which was unusually abundant on sweet maize; *Epicauta pennsylvanica*, DeG., and *E. marginata*, F., on tomatos; *E. vittata*, F., on asters and dahlias; *Agrotis ypsilon*, Rott. (black cutworm), injuring maize and vegetable crops; *Diabrotica duodecimpunctata*, F. (spotted cucumber beetle), attacking the roots of maize; *Diarthronomyia hypogaea*, Lw. (chrysanthemum midge), which occurred in small numbers in greenhouses throughout the State; *Tarsonemus pallidus*, Banks (cyclamen mite), which was found infesting chrysanthemums and other plants in greenhouses, and was also observed for the first time in the open in three widely separated localities on *Delphinium*; *Rhizoglyphus hyacinthi*, Boisd. (bulb mite), which attracted attention for the first time by injuring *Gladiolus* and garden lilies; and *Macronoctua onusta*, Grote (iris borer), which occurred in large numbers on *Iris* in sheltered town gardens, but which only slightly infested plantings in the open field.

Gabotto (L.). **Gli insetti nocivi alle principali piante legnose coltivate.** [Insect Pests of the principal cultivated woody Plants.] —F'scap 8vo, viii+100 pp., 40 figs. Turin, G. B. Paravia & C., 1929. Price *Lire* 8.50.

This is an elementary booklet on insects and mites, particularly those that attack fruit-trees, olives and vines, in Italy. It contains popular descriptions of the various pests and the injury they do, with notes on their control.

Robinson (D. H.) & Jary (S. G.). **Agricultural Entomology.**— Cr. 8vo, xi+314 pp., 149 figs. London, Duckworth, 1929. Price 15*s.* net.

In the first part of this book (pp. 1–43), the authors give a brief general account of the morphology, metamorphosis and classification of insects. The second part (pp. 45–271) contains an account of the more important injurious and beneficial insects occurring in Britain, under their orders and families, the principal characters of which are given. The appearance and life-history of each species or group are described, and recommendations for control are made. The authors point out that although the application of insecticides is often worth while on a small scale and against fruit pests, it is not usually possible on the farm; they have therefore endeavoured to show how pests can be controlled by rotation of crops, cultural methods, etc. Two concluding chapters of the second part deal with the general principles of insect control and the composition and application of insecticides, and three appendices are devoted to brief accounts of injurious Crustacea, Arachnida and Myriapoda, eelworms, and Mollusca.

It may be noted that figures 70 and 72 have been transposed.

Speyer (E.). **The Red Spider Mite.** (*Tetranychus telarius*, **L.**)—*J. Pomol. & Hortic. Sci.*, vii, no. 3, pp. 161–171, 2 pls. London, December 1928.

A detailed account is given of the bionomics and control of *Tetranychus telarius*, L. (red spider) as a pest in greenhouses [*cf. R.A.E.*, A,

xiii, 371 ; xiv, 343, etc.]. Hibernating mites become active on warm days and are then gregarious ; but when the temperature is below freezing point, they are inactive except in the presence of sunlight, and die quickly in the absence of moisture, even if other conditions are favourable to them. Hibernation takes place in pieces of moist wood (plant staging, etc.) and in weeds, the presence of which in the vicinity of glasshouses is often a source of infestation. In the absence of sunlight the mites prefer a temperature of 50° F., and when the glasshouses are heated and planted in January, they tend to move to the upper parts, where a suitable temperature may be obtained. At almost any time after May, the mites become so numerous on a single plant that the food-supply is exhausted, and migration to other plants takes place. At the beginning of August, there is often a more or less definite migration of adults from the glasshouses, even if the food-supply is plentiful ; the mites congregate in large masses on the ridge-capping of the houses, and if there is any wind, some of them detach themselves on short threads and are blown considerable distances, being subsequently found laying eggs on leguminous plants in the open. At temperatures above 64° F., breeding may continue throughout the winter on carnations and tomato ; but on such plants as banana, *Datura* and *Salvia*, the mites remain inactive irrespective of the temperature. When breeding occurs early in the year, the life-cycle may last several weeks, but with the rise of temperature in April there is a rapid sequence of generations. Oviposition occurs over a period of 3 weeks, and the eggs, which hatch in 3–9 days, are laid at the rate of about 4 a day.

The control of *T. telarius* in glasshouses is discussed [*loc. cit.*] The mechanical volatilisation of naphthalene from lamps, at the rate of 10 oz. crude naphthalene to every 1,000 cu. ft. space over a period of 10–12 hours, is very effective, provided that a temperature of 70° F. can be maintained. The fumigation must be carried out not later than the middle of October, as the vapour will not kill mites that have left the plants and reached places of concealment, unless high temperatures can be maintained. If naphthalene has not been used, the houses should be thoroughly cleansed during the winter with a mixture of 1 part cresylic acid (98 per cent.) to 40 parts water, or with 8 lb. potash soap, dissolved by heat with 1 gal. cresylic acid, at the rate of 1 part of the mixture to 40 parts water. The outsides of the houses should also be sprayed, and a second application should be made 3 weeks before replanting early in the year ; ventilators should be kept closed for 4 days after spraying and a good heat maintained. The fumes of cresylic acid are exceedingly injurious to plants, and the sprays cannot, therefore, be used on growing plants. Sulphur is not recommended as a fumigant, since the sulphur dioxide produced hardens the foliage and acts as a repellent, mites which would normally have been removed with the plants being left behind when it is used just before the houses are cleared.

Cucumber, tomato and melon plants may be effectively sprayed with a petroleum oil emulsion. The emulsion is useless on carnations, as the bloom on the foliage absorbs the oil and is destroyed by it, and there is insufficient left to kill the mites. The emulsions should be made of heavy refined petroleum oils, with a specific gravity of from 0·86 to 0·95 and free from unsaturated hydrocarbons, products of oxidation or sulphur, and diluted to contain from 0·75 to 1 per cent. oil. They should contain the smallest possible quantity of substances such as soft soap

and caseinate, and no spreader such as saponin should be added to the spraying water, since too large a proportion of emulsifiers, or the presence of a spreader, appears to make the oil run off the mites and foliage. These emulsions may be used with hard water, as 7 per cent. oil is sufficient to prevent deposition of salts if a potash soft soap is used as an emulsifier. If a caseinate is used as an emulsifier, some preservative must be added to prevent bacterial decomposition. If the temperature is low, a second spray should be applied after 7–14 days, as a number of eggs may hatch. Owing to the conservation of moisture at the leaf surface, plants require less water after treatment with the emulsions. Sprayed plants are not liable to reinvasion by *T. telarius* for at least 11 days.

Where soft water is available, a mixture containing 0·5 per cent. soft soap and 0·25 per cent. liver of sulphur has been found effective and is probably more rapid than any other known spray. This spray is especially recommended for tomatos, although a slight scorching of the foliage may be expected if it is applied in hot, bright weather, and brown marks on the fruit necessitate wiping before sending to market; it is the only spray that has been successful in the control of the mite on carnations, and only stains the foliage to a slight degree. The spray should be made with a good potash soap, as excess alkali may be injurious, especially to cucumber. Concentrated stock solutions may be best made with fusel oil (amyl alcohol), as this dissolves the soap (which is then mixed with the solution of liver of sulphur) and prevents the deposition of sulphur.

Large numbers of mites may be trapped in dry straw strewn over the ground surface between the rows of plants, or in strips of corrugated paper placed on the hot water pipes over the pipe-hooks, if this is put down at the beginning of October and removed and burnt at weekly intervals until the middle of November. It is recommended that the ridge-capping of the houses should be raised from the apex of the roof so that a gap of at least $\frac{1}{4}$ in. is left between the two, and that canes should not be used as supports, as these harbour large numbers of hibernating mites; all staging should be stored in a dry shed when not in use.

Theobald (F. V.). **Tar Distillate Trials in Kent and West Sussex in 1928.**—*J. Pomol. & Hortic. Sci.*, vii, no. 3, pp. 199–211, 3 pls. London, December 1928.

Sprays of various proprietary tar distillate washes, applied on 28th February 1928 to old gooseberry bushes that were badly infested with *Aphis grossulariae*, Kalt., caused a very marked reduction of the insect by 20th June, but a very slight attack of Capsids took place in the latter month mainly on the lower parts of the bushes. Colonies of red spider (*Bryobia ribis*, Thomas) present on the bushes were examined on 24th April; though the mites were killed, the eggs were not affected.

An old, unhealthy apple orchard was sprayed between 7th and 10th February with these washes at 10 per cent. strength. By mid-June the treated trees were clean or almost so, whereas the controls were heavily infested with *Anuraphis roseus*, Bak., *Rhopalosiphum prunifoliae*, Fitch, and woolly aphis [*Eriosoma lanigerum*, Hausm.], no other insect pests being present. It is pointed out that a sappy growth encouraged by an excess of nitrogenous manure attracts Aphids,

and that potash counteracts this. Another old apple orchard that had been untreated for some time was sprayed under pressure in the third week of February with 7½ and 5 per cent. washes, each tree requiring 7–9 gals., and finally examined on 25th May. *Psylla mali*, Schmidb., was completely controlled; *A. roseus* and *R. prunifoliae* nearly so. Woolly aphis was much reduced, and many of the eggs of the winter moth [*Cheimatobia brumata*, L.], and all those of the vapourer moth [*Notolophus antiquus*, L.] had been killed; but those of red spider, as well as hibernating larvae of *Colcophora nigricella*, Stph., and *Arctornis* (*Leucoma*) *chrysorrhoea*, L. (gold tail moth) were not affected. Mussel scale [*Lepidosaphes ulmi*, L.] and brown scale [*Lecanium capreae*, L.] were killed, and the trees were so well cleaned that spring spraying was unnecessary.

In a plantation of cob nuts over 100 years old, but in full bearing, treated before 6th January with these washes up to 7½ per cent., it was found on 20th June, that the eggs of *Myzocallis coryli*, Goeze, and of *Macrosiphum* (*Myzus*) *avellanae*, Schr., had not been destroyed, infestation being severe; the former certainly oviposits on the nuts, sexual forms occurring in October; and stem mothers of the latter were found on the trees in May. Winter moth and Tortricids were considerably reduced, and brown scale (*Lecanium coryli*, L.) was completely destroyed.

Against the apple Capsid, *Plesiocoris rugicollis*, Fall., the effect of 10 per cent. washes was materially to lessen the damage to foliage and fruit. On black currants, 6 per cent. washes proved of no value whatever against *Lygus pabulinus*, L., but definitely controlled the Aphids present.

JARY (S. G.). **Tar-distillate Winter Washes and the Apple Capsid Bug.** —*J. Min. Agric.*, xxxv, no. 10, pp. 917–921. London, January 1929.

Owing to the inconsistent results previously obtained from the use of tar distillate washes against the eggs of *Plesiocoris rugicollis*, Fall. (apple Capsid) [*R.A.E.*, A, xvi, 338], which has become a serious pest in England and is difficult and expensive to control, further experiments were carried out with a single brand of tar distillate.

The intensity of infestation varies, not only on different varieties of apple, but also on adjacent trees of the same variety. In order to allow for this in the tests, bush trees that differed in infestation from 5 to 80 per cent. of leaf trusses in June 1927 were grouped into five lots, each showing about 50 per cent. average infestation. In February 1928 the first lot was sprayed with 10 per cent. tar distillate, the second with 7½ per cent. followed by 10 per cent. two days later, the third with a 2 per cent. solution of caustic soda followed by 10 per cent. tar distillate two days later, and the fourth with a mixture containing two parts of a 15 per cent. tar distillate and one part of 5 per cent. caustic soda solution, the whole being stirred and the tarry scum removed before application; the fifth lot was left untreated. The spraying was exceptionally thorough. The average percentage of attacked leaf trusses was again estimated for each lot on 11th May and on 13th July. They varied from 1·6 to 2·1 on the former date and from 9·4 to 11 on the latter, as compared with 8·4 and 29 for the unsprayed lot. The mixed spray proved the best, since a tree

could be covered well with two-thirds the quantity required when an ordinary 10 per cent. tar distillate wash was used ; furthermore tarry substances, which tend to clog spraying machinery, float to the top and can be discarded.

KÉLER (S.). **Błyszczka jarzynówka** (*Plusia gamma*, **L.**) **jej szkodliwość i zwalczanie.** [*Phytometra gamma*, L., the Damage it does and its Control.]—*Gaz. cukrown.*, 1928, no. 36, reprint 8 pp. Warsaw, 1928.

In the summer of 1928 a serious outbreak of *Phytometra* (*Plusia*) *gamma*, L., occurred in the southern part of the Pozen district and the south-east of Pomerania, the larvae being especially abundant in July, when they caused great damage to beets. They did not attack strips of beets planted in sandy soil although surrounding fields were severely infested. They were first observed on turnips and peas, and then migrated to beets and potatoes. Mustard was not attacked, but chicory was considerably damaged. The outbreak was checked by an epidemic caused by the fungus, *Entomophthora plusiae*. Although in some cases the infected larvae pupated, the pupae always died before the adults emerged.

Arsenical sprays or dusts are effective against the larvae, as they feed in exposed positions on the leaves of the plants. When carefully and properly used, calcium arsenate, Paris green and other poisons do not affect vegetables, the poisonous residues being negligible. As additional measures, trenches with pits dug at intervals at the bottom should be used to trap the migrating larvae ; poultry should be allowed to run in infested fields ; and the pupae and adult moths should be collected.

HASE (A.). **Kurzschluss durch Mehlmotten** (*Ephestia kuehniella* **Zell. Lepidopt.**). [Short-circuit caused by *E. kühniella*.] —*Gesundheits-Ingenieur*, 1928, pt. 24, reprint 1 p., 1 fig. Berlin, 1928.

Repeated burning of fuses followed by a short-circuit in an electric power current in Berlin was found to be due to the fact that fifteen larvae of *Ephestia kühniella*, Zell., had pupated in the switch. The interior of the cup was full of the webs that the larvae spin before pupating.

DOUENCE (A.). **Sur une invasion de Tipules.**—*Rev. Path. vég. Ent. agric.*, xv, fasc. 6, pp. 156–159. Paris, June 1928.

An account is given of an outbreak of Tipulid larvae in the west of France during May 1928, the severity of which was probably due to the extremely wet spring. The greatest damage occurred where spring oats or barley were sown on land that had been under leguminous crops or lain fallow during the previous year. Poison baits of wheat bran or sawdust, sprinkled with molasses and water and mixed with arsenical salts, such as Paris green, sodium arsenate, or lead arsenate, or with zinc phosphide, at an average rate of 1 part of arsenate or phosphide to 17 parts of bran or 25 parts of sawdust, are recommended, but no results of experiments that were made with these baits are given. The larvae avoid the drier parts of the ground near hedges and trees,and careful draining of the soil appears to be the only cultural measure of any value.

PAPERS NOTICED BY TITLE ONLY.

UVAROV (B. P.). **Insect Nutrition and Metabolism. A Summary of the Literature.**—*Trans. Ent. Soc. London*, lxxvi, pp. 255–343, 24 pp. refs. London, January 1929.

[UVAROV (B. P.).] **Уваров (Б. П.). The Food, Nutrition and Metabolism of Insects.** [*In Russian.*] [A brief Summary of the foregoing.]—*Priroda*, 1928, no. 10, pp. 898–914, 8 refs. Leningrad, 1928.

BODINE (J. H.). **Insect Metabolism. The Anaërobic Metabolism of an Insect (Orthoptera).**—*Biol. Bull.*, lv, no. 6, pp. 395–403, 7 figs., 9 refs. Woods Hole, Mass., December 1928.

CHINA (W. E.). **A new Species of *Dasynus*, Burm.** [*piperis*, sp. n.] **injurious to Pepper in Java (Heteroptera, Coreidae).**—*Bull. Ent. Res.*, xix, pt. 3, pp. 253–254, 1 fig. London, December 1928.

HALL (W. J.). **Observations on the Coccidae of Southern Rhodesia. I.** [31 Species of DIASPINAE including 17 new ones.]—*Bull. Ent. Res.*, xix, pt. 3, pp. 271–292, 15 figs., 5 refs. London, December 1928.

GRANOVSKY (A. A.). **A Review of *Myzocallis* Species inhabiting *Alnus*, with Description of a new Species (Homoptera, Aphidae).**—*Ann. Ent. Soc. Amer.*, xxi, no. 4, pp. 546–565, 1 pl., 18 refs. Columbus, Ohio, December 1928.

HOKE (G.). **Some undescribed Diaspines from Mississippi, II. (Homoptera : Coccidae.)**—*Ann. Ent. Soc. Amer.*, xxi, no. 4, pp. 671–676, 2 pls. Columbus, Ohio, December 1298.

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PORTER (C. E.). **Un Cóccido nuevo para la República Argentina.**—*Physis*, ix, no. 32, p. 144. Buenos Aires, 10th August 1928.

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KURISAKI (M.). **Supplementary Notes to a Study of the Ladybird, *Ptychanatis* Crotch.** [*In Japanese.*]—*Kyushu Teik. Daig. Nôg. Gak. Z.*, ii, no. 5, pp. 324–339, 2 pls., 3 figs., 4 tables, 1927. (With a Summary in English.) (Abstract in *Jap. J. Zool.*, ii, no. 1, p. (20). Tokyo, 31st December 1928.)

UCHIDA (T.). **Dritter Beitrag zur Ichneumoniden-Fauna Japans.**—*J. Fac. Agric. Hokkaido Imp. Univ.*, xxv, pt. 1, pp. 1–115, 3 pls. Sapporo, December 1928. [*Cf. R.A.E.*, A, xvi, 392.]

KÉLER (S.). **Ein Beitrag zur Kenntnis der Gattung *Pimpla* in Polen.** [Contribution to the Knowledge of the Genus *Pimpla* in Poland.]—*Rozpr. Muz. Dzied.*, x, pp. 100–109, 1 fig., 15 refs. Lemberg, 1928.

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[Greze (N.).] **Грезе (М.). Braconids reared from Bark-beetles in the Ukraine.** [*In Ukrainian.*]—*Mitt. forstl. Versuchswes. Ukraine*, pt. ix, pp. 137–139, 2 refs. Kiev, 1928.

Aravena (R. O.). **Insectos encontrados en estómagos de aves.** [Insects found in the Stomachs of Birds.]—*Rev. Soc. ent. argent.*, ii, no. 1, pp. 61–62. Buenos Aires, 31st July 1928.

Bruneteau (J.). **Contribution à l'étude anatomique du doryphore (*Leptinotarsa decemlineata* Say) à l'état d'insecte parfait.**—*Rev. Zool. agric.*, xxvii, no. 7, pp. 101–110, 6 figs.; no. 8, pp. 125–128, 2 figs. Bordeaux, July & August 1928.

Kono (H.). **Eine Liste der Apioninen Japans, mit der Beschreibung einer Neuen Art.** [List of the Apionini of Japan with Description of a new Species.]—*Trans. Sapporo Nat. Hist. Soc.*, ix, pt. 2, pp. 239–242, 1 fig. Sapporo, Japan 1927.

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Daviault (L.). **Notes biologiques sur la bruche du haricot (*Acanthoscelides obtectus*, Say).** [Notes on the Biology of *Bruchus obtectus*.]—*Rev. Path. vég. Ent. agric.*, xv, fasc. 7, pp. 188–193, 10 refs. Paris, 1928. [*Cf. R.A.E.*, A, xv, 203.]

Conde (O.). **Ostbaltische Tenthredinoidea.** [A List of 229 Species of Tenthredinids of the East Baltic with some Food-plants.]—*Korr Bl. Naturf Ver. Riga*, lix, pp. 67–91, 2 pls., 25 refs. Riga, 1927. [Recd. February 1929.]

Ramakrishna Ayyar (T. V.). **A Contribution to our Knowledge of the Thysanoptera of India.**—*Mem. Dept. Agric. India*, Ent. Ser., x, no. 7, pp. 217–316, 2 pls., 33 figs. Calcutta, August 1928.

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Horn (W.) & Schenkling (S.). **Index Litteraturae Entomologicae. Serie I. Die Welt-Literatur über die gesamte Entomologie bis inklusive 1863.** Bd. IV, Schaum-Zwinger und Nachtrag, pp. xxi & 1057–1426, 1 pl. Berlin-Dahlem, Dr. W. Horn, 1929. Price *Mk.* 18.75, per vol; the complete work, *Mk.* 75. [*Cf. R.A.E.*, A, xvi, 491; xvii, 127.]

Ferris (G. F.). **The Principles of Systematic Entomology.**—*Stanford Univ. Pub. Biol. Sci.*, v, no. 3, pp. 101–269, 11 figs. Stanford Univ., Cal., 1928. Price, paper, $2.00; cloth, $2.75.

Wiesmann (R.). **Die beiden Knospenwickler; *Tmetocera* (*Eucosma*) *ocellana* F. und *Olethreutes variegana* Hb. als Knospenschädlinge der Apfelbäume im Wallis 1926-27.** [The two Bud-moths, *Eucosma ocellana*, Schiff., and *Argyroploce variegana*, Hb., as Apple Bud Pests in Valais in 1926–27.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvi, no. 26, pp. 527–532, 9 figs. Wädenswil, 24th December 1927. [See *R.A.E.*, A, xv, 645.]

Clerc (A.). **A propos du** *Pantomorus godmani* **(Crotch). (Col. Curculionidae.)**—*Bull. Soc. ent. Fr.*, 1928, no. 18, pp. 290–292, 3 refs. Paris, 1928.

Three individuals of the weevil, *Pantomorus godmani*, Crotch, were taken in a garden in Var (S.E. France) in August 1928; it was not found again until 2nd October when six more were taken. The weevils were found exclusively on a malvaceous bush, probably *Abutilon* sp., which was severely damaged. The distribution of *P. godmani*, which is a polyphagous pest in various parts of the world, is discussed, this being apparently the first record from France. It is mainly nocturnal in its habits, although it was active in the sun in August; in captivity the weevils were kept alive for about a fortnight on rose leaves. The author points out that *P. godmani* requires a hot climate, and it will probably not breed to any extent in France.

Timon-David (J.). **Sur les variations des graisses de réserve pendant l'évolution de la pyrale du maïs** (*Pyrausta nubilalis* **Hübn.).**—*C.R. Soc. Biol.*, xcix, no. 36, pp. 1799–1800, 2 refs. Paris, 14th December 1928.

Observations of the hibernating larvae of *Pyrausta nubilalis*, Hb., show that they contained in November 26·5 per cent. of clear yellow oil, consisting of 13·5 per cent. saturated (stearic) acids and 81 per cent. unsaturated acids (oleic, linoleic, etc.). Extractions made by means of ether during the hibernation period show that this fat content increased to 27·2 per cent. in February in larvae on *Artemisia*, and in larvae on maize to 27·9 per cent. in March, with a slight decrease to 27·3 per cent. in May, although the larvae had been entirely without nourishment for 7 months. The accumulation of fat is thus obviously not a protection against inanition and cold. Examination of the pupae, however, showed only a 14·8 per cent. content of oil, further observations of the larvae indicating that a reduction begins immediately before pupation and is continued during the pupal stage.

Frappa (C.). **Sur un ennemi du caféier à Madagascar, le bostryche du caféier.**—*Bull. écon. Madagascar*, 1928, Partie documentaire, reprint 4 pp. Tananarive, 1928.

The Scolytid, *Xyleborus coffeae*, Wurth, is a serious pest of coffee in Madagascar. The female bores into a young branch until it reaches the centre; it then forms a larger tunnel at right angles to the first one in which it lays a number of eggs, usually between 30 and 60. The larvae hatch in a short time and feed on the wood and on the fungi that are always numerous on the walls of the galleries. Pupation takes place within the tunnel, and the adults make their way into the open for pairing. There appear to be several generations in the year, but these always overlap, all stages of the insect being present at the same time. The injury is described. The borer was always more numerous in plantings where the trees were weakened by growing in exposed positions or in infertile soil. Contrary to general opinion, the small native plantations near villages where the bushes are well manured with offal of all sorts and with wood ash are free from the pest. The distribution of the beetle in Madagascar is given. The only effective method of control is pruning [*R.A.E.*, A, xvi, 625].

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Van Zwaluwenburg (R. H.), Rust (E. W.) & Rosa (J. S.). **Notes on the Rice-borer,** *Chilo simplex.*—*Hawaii. For. & Agric.*, xxv, no. 3, pp. 79–82. Honolulu, 1928.

Chilo simplex, Butl. (rice borer) was first observed as a pest of rice in Hawaii in the autumn of 1927. It occurs on the islands of Oahu and Kauai and was probably introduced from Japan in rice straw used as packing for merchandise. The larva feeds on the inner stem and kills the central leaf. Badly infested crops show a high percentage of dead shoots and leaves and frequently fail to set grain ; they are very liable to be laid by wind and rain. In certain areas the damage by *C. simplex* has been very severe, in one case resulting in the entire loss of the July crop. Eggs are laid in clusters of often over 100, on the leaf-blade or between the leaf-sheath and the main stem ; they hatch in 6 to 7 days. Pupation takes place in the stem, and the pupal stage lasts about 10 days. The preferred food-plant of *C. simplex* is rice, but *Echinochloa* spp., and to a less extent other grasses, are also attacked ; it has not been recorded from sugar-cane in Hawaii. It has been observed to be attacked in Oahu by *Trichogramma minutum*, Riley, and *Cremastus hymeniae*, Vier., which parasitise the eggs and larvae respectively, *Polistes hebraeus*, F., the ant, *Pheidole megacephala*, F., and the mynah bird (*Acridotheres tristis*). An undetermined Ichneumonid that was observed for the first time in large numbers in the rice-fields is also probably parasitic on it.

Attempts have been made to introduce natural enemies of this Pyralid from Japan, and the following have been liberated : *Phanurus beneficiens*, Zehnt., and *Trichogramma japonicum*, Ashm., which parasitise the eggs; and *Amyosoma chilonis*, Vier., and *Apanteles* sp., which parasitise the larvae. The egg-parasites were reared through a generation in the laboratory, and 23,000 individuals of *P. beneficiens* and 33,000 of *T. japonicum* were liberated. The latter has been bred several times from eggs of *C. simplex* collected in the field.

Fullaway (D. T.). **Annual Report, Division of Entomology 1927.**—*Hawaii. For. & Agric.*, xxv, no. 3, pp. 88–89. Honolulu, 1928.

Termites are very destructive to buildings in Hawaii, and during 1927 a fairly capable field force was organised to deal with them, but it is thought that unless a natural check can be found, the possible existence of which is indicated by investigations made by the author in the Far East, termite control in Hawaii can only be obtained by the use of termite-proof material in buildings. The use of termite guards over masonry foundations affords some measure of relief from the attacks of the ground-inhabiting species, and gassing and poisoning are effective for the protection of individual properties, but the cost of this means of control for the area involved would be excessive.

A search was made for the natural enemies of *Argyroploce illepida*, Butl. (macadamia nut borer) in Formosa and Japan, but neither the borer nor any likely enemies was found. An attempt was also made to introduce natural enemies of *Adoretus sinicus*, Burm. (Japanese beetle) from Formosa ; several generations of a wasp [*Tiphia* sp.] and a fly [*Ochromeigenia ormioides*, Towns.] were successfully bred in outdoor cages and liberated, but both disappeared in the cages after heavy rains in January.

French (C.), jr. **Insect Pests.**—*J. Dept. Agric. Vict.*, xxvi, pt. 11, pp. 649–652. Melbourne, November 1928.

This is a brief account of insect pests of fruit-trees, flowers, vegetables, greenhouse plants, etc., in Victoria, the popular names only being given.

Levick (G. T.). **Our Insect Friends.**—*J. Dept. Agric. Vict.*, xxvi, pt. 11, pp. 653–656. Melbourne, November 1928.

This is a popular account of beneficial insects, and includes a short review of some parasites and predators in Victoria and of work on the introduction of insects to control noxious plants in Australia and New Zealand.

Tanaka (K.). **On *Agrilus auriventris*, Saund., a serious Pest of *Citrus*.** [*In Japanese.*]—*Agric. & Hortic.*, iii, no. 12, pp. 1437–1444, 21 figs. Tokyo, December 1928.

The Buprestid, *Agrilus auriventris*, Saund., is widely distributed in Kiushiu, Formosa and the intervening islands, and is very destructive to *Citrus* in Kiushiu. It attacks already weakened trees, which are often killed by it. There is one generation a year near Nagasaki, the adults occurring from the beginning of June to the middle of September, but being most numerous in June and July. They feed on the leaves and are very active on fine days. The eggs are laid in injured parts or cracks on the branches and stems. One female may deposit an average of 50 eggs, 4–20 being laid at a time. The larvae hatch in 10–20 days and are found under the bark until November or December, when they bore into the wood, where they hibernate. Pupation takes place in late April or May.

Nakayama (S.). **On the Natural Enemies of *Chilo simplex*, Butl., in Korea.** [*In Japanese.*]—*Dobutsugaku Zasshi* [*Zool. Mag.*], xl, no. 482, p. 481. Tokyo, December 1928.

Phanurus (*Ceraphron*) *beneficiens*, Zehnt., and *Trichogramma japonicum*, Ashm., are recorded from Japan and Korea as parasites of the eggs of the rice borer, *Chilo simplex*, Butl. An average of 39·7 of the eggs is said to be destroyed in Korea.

McConnell (H. S.). **The Oriental Fruit Moth.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 179–180, 1 ref. College Park, Md., July 1928.

Cydia (*Laspeyresia*) *molesta*, Busck, was found in larger numbers in apples grown in the east of Maryland than in those grown in the west. The principal parasite of this moth in Maryland is *Macrocentrus ancylivora*, Roh., which is usually first found in considerable numbers in the spring, but has not yet been reared from material collected in the west of the State. *Trichogramma minutum*, Riley, is an important egg parasite, especially late in the season. *Glypta rufiscutellaris*, Cress., and *Pimpla* (*Epiurus*) *indagator*, Cress., are more numerous than any other species in the west of the State ; they have been bred from overwintering larvae and are present in limited numbers throughout the season. *Microbracon gelechiae*, Ashm., was found in considerable numbers late in the season of 1925.

McConnell (H. S.). **The Rosy Apple Aphis.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 180–181. College Park, Md., July 1928.

During the past three years injury to apple by *Anuraphis roseus*, Baker (rosy apple aphis) has been slight. The eggs are usually laid on the lower and outer branches and hatch about the time the leaves appear in spring. The emerging Aphids feed in the opening leaf-bud clusters and mature in 20–30 days, a second generation being produced a few days later. Gradual migration to the alternative food-plant of this species, the narrow leafed plantain (*Plantago lanceolata*), occurs during the summer, generally beginning with the third generation, a considerable proportion of which becomes winged; breeding records made during 1927 indicate that all the sixth generation migrate from the apple trees. Several apterous generations occur on plantain, and in the early autumn winged females and males are produced, which return to apple. The females occur first and give rise to a generation of wingless oviparous forms, with which the males pair. Considerable difficulty was encountered in rearing the Aphids in screen cages as they were heavily parasitised by *Lysiphlebus testaceipes*, Cress.

Sanders (P. D.). **The Plum Curculio.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 181–184. College Park, Md., July 1928.

Much of the information here given on *Conotrachelus nenuphar*, Hbst. (plum curculio) on apples and peaches in Maryland has already been noticed [*R.A.E.*, A, xvi, 451]. In experiments the beetles did not pair or oviposit until after hibernation.

Cory (E. N.). **Experiments with Pine Oil Preparations.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 184–186. College Park, Md., July 1928.

Experiments have been made with emulsions containing paradichlorobenzene against borers in fruit trees; as this substance was found to be only slightly soluble in lubricating oils, the emulsions were made with pine oil. A table is given showing the solubility of paradichlorobenzene in pine oil; the oil was slightly heated and the amount of crystallisation noted as the cooling progressed, the maximum amount dissolved being apparently 1 gm. in 1 cc. pine oil. Tests were made on four apple and four peach trees with pine oil impregnated with paradichlorobenzene and emulsified with either sodium hydroxide or potash fish-oil soap, and pine oil emulsion alone, both emulsions being diluted 1 : 9. The soil was removed to a depth of 3 ins. round the tree, and the emulsion sprayed on, the soil being then replaced. The trees were not injured, but no control of the borers was obtained. Tests were made on the same trees at a later date with a stock emulsion of 100 gms. paradichlorobenzene to 100 cc. pine oil, with soap as an emulsifier. Dilutions of this emulsion at the rate of 1 : 9 and 1 : 4 were each used on two apple trees and one peach tree. The apple trees were all injured and all but one borer killed; on the peach trees a complete kill was obtained, and none of the trees was injured. This and previous work with pine oils indicate that the materials have considerable promise. Fractional distillations of seven samples of pine oil gave from 2 to 4 fractions in addition to the residue, at

temperatures ranging from 95 to 200° C. ; those that came off at the highest temperatures were the most toxic to mealybugs. Tests of the crude material, alone and in emulsions, showed that the volatile emanations were markedly repellent to ants.

CORY (E. N.). **Control of the Iris Borer.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, p. 186. College Park, Md., July 1928.

In 1927 *Macronoctua onusta*, Grote (iris borer) was observed in Maryland for the first time in two nurseries. After the larvae had pupated, experiments were made with carbon bisulphide emulsion prepared with resin fish-oil soap [*R.A.E.*, A, xiii, 568], diluted with an equal volume of water. One plot was treated at the rate of 5 cc. to 1 U.S. gal. water, and the second with the same amount of water, containing only half as much emulsion ; the diluted emulsion was used at the rate of 1·8 U.S. gals. to a square foot. Applications were made on 9th August and on examination 5 days later, 12 pupae were removed from the first plot and 13 from the second, one pupa being alive in each lot. The iris plants were not injured by the treatment. It would be better to make the applications when the borer is in the larval stage, the last week in July being probably the best time.

MCCONNELL (H. S.). **Control Experiments on the Oyster Shell Scale.—.** *Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 186–187. College, Park, Md., July 1928.

Experiments conducted during the summer of 1927 with white oil emulsions (Volck) against *Lepidosaphes ulmi*, L. (oyster shell scale) on red dogwood (*Cornus stolonifera*) in Maryland are briefly described, and the following recommendations are made : For the control of the first generation, a 2 per cent. white oil emulsion should be applied during the first week in May, or soon after the eggs are observed to be hatching, followed by a second application after three weeks. An application against the second generation should be made during the third week in July, a second spray being applied as before after three weeks.

SANDERS (P. D.). **Control Experiments on Euonymus Scale.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 187–188. College Park, Md., July 1928.

Experiments against *Chionaspis euonymi*, Comst., on *Euonymus* in Maryland showed that a late dormant spray of 1 gal. Sunoco oil to 20 gals. water gives good results if a thorough spraying can be effected, for which it is often necessary to prune the bushes. A white oil emulsion containing 2 per cent. oil showed great promise as a summer control for the scale.

PELTIER (P. X.). **Preliminary Report on some Phases of the Potato Tuber Moth Study in Maryland.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 189–192. College Park, Md., July 1928.

The larvae of *Phthorimaea operculella*, Zell. (potato tuber moth) mine in the foliage and stems of the potato plant and also tunnel through the tubers. As a result of a campaign in part of Maryland in 1925, as well as of adverse weather conditions, moths were only found in one

packing shed in 1926 where the recommendations had been disregarded. The moths were observed on 8th April, when no potato plants were above the ground, but this is the only positive evidence of successful hibernation by *P. operculella* obtained.

In preliminary tests in the laboratory, calcium arsenate, lead arsenate, magnesium arsenite and Bordeaux mixture only gave a very slight control of the larvae mining in the leaves. Experiments were made with various substances as repellents to protect potato tubers from the ovipositing moths. Separate lots of tubers were dusted with seven common insecticides and placed in small paper sacks, left open at the top, in a cage in which a large number of ovipositing females were confined; all the lots except those treated with sodium fluoride and calcium fluosilicate, the infestation on which was very slight, were heavily attacked. In the second experiment potatoes treated with calcium fluosilicate showed a slight, and those treated with sodium fluosilicate and sodium fluoride a very slight, infestation. Batches of 60 tubers were then exposed to ovipositing moths for a period of 48 hours; one egg was deposited on potatoes treated with sodium fluoride, one on those treated with sodium fluosilicate, and 21 on untreated tubers. The assumption that *P. operculella* is most abundant in dry seasons has been confirmed in Maryland.

CORY (E. N.). **The Effectiveness of several Grades of Carbon Bisulphide.** —*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 192–195. College Park, Md., July 1928.

This is a summary of a dissertation prepared by R. C. Burdette on experiments to find whether commercial brands of carbon bisulphide give better results than the chemically pure material. The fumigations were carried out against the eggs of the Angoumois grain moth [*Sitotroga cerealella*, Ol.]. No consistently better results were obtained from the use of the commercial grades, but as these are cheaper than the chemically pure material, it is possible that there might be a tendency to use more of them. Fumigation with 3 lb. carbon bisulphide to 1,000 cu. ft. for 4 hours seemed to be the minimum amount that could be used for effective control. The length of exposure and the amount of the fumigant used are apparently the determining factors in successful fumigation, with ordinary humidity and a temperature range of 70–80° F. The difference between the effects of 3 and 1 lb. carbon bisulphide to 1,000 cu. ft. was much more marked at a humidity of 90 to 100 per cent. than at one of 10 per cent. At 10 per cent. humidity 1 lb. carbon bisulphide gave 100 per cent. control in 6 hours.

SANDERS (P. D.). **Control of Bees burrowing in Lawns.**—*Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 196–197. College Park, Md., July 1928.

In 1923, a solitary bee, *Andrena perplexa*, Smith, was present in sufficient numbers to cause considerable damage to a lawn. Experiments in subsequent years showed that almost complete control could be obtained with carbon bisulphide emulsion, but dusting with calcium cyanide not only failed to destroy the infestation, but injured the grass.

Wiesmann (R.). **Untersuchungen über die Biologie und Bekämpfung der Obstmade** (*Carpocapsa pomonella* **L.**) **in den Jahren 1926-27.** [Investigations on the Biology and Control of the Apple Maggot, *Cydia pomonella*, in 1926–27.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvi, no. 26, pp. 508–519, 3 figs., 10 refs. Wädenswil, 24th December 1927.

Field and laboratory investigations on the biology of *Cydia* (*Carpocapsa*) *pomonella*, L., were made in the canton of Zurich, Switzerland, in 1926–27. In both years the pupation began 1–1½ weeks after apple blossoming, and the moths emerged 5–6 weeks after the blossoming. Oviposition followed almost immediately, and the eggs hatched in about a week. A second generation was not observed. Possibly the prolonged flight period of the moths may result in late infestations that are ascribed to a second generation. The young caterpillars were observed to feed for about 10 days in various places on the surface of the fruit before penetrating into the core. Stalk, side, and calyx feeding occurred in about equal porportions.

Direct calyx spraying appears to be of less importance in Switzerland than in America. It is not necessary to spray immediately after the trees blossom, as feeding only begins about 6 weeks later, and it is sufficient to poison the outside of the calyx leaves. As the larva also feeds on the surface of the fruit, better protection is given by spraying when the apples are about the size of a walnut. In both 1926 and 1927 the flight lasted two months, and the larvae were present from the end of June to early August, so that the fruits required protection over a long period. Experiments in spraying about 4–5 weeks after blossoming were made. The fruits were about 1 inch in diameter, and the spray contained 2 per cent. lead arsenate and 2 per cent. lime-sulphur. The percentage of infestation in two localities was thereby reduced from 21·5 to 2·5 and from 13·4 to 2·1.

[Beĭ-Bienko-Baranovskaya (V. F.).] **Бей-Биенко-Барановская (В.Ф.). Observations on Dipterous Pests of Onion.** [*In Russian.*]—*Trud. sib. Inst. Sel. Khoz. Lesovod.*, x, reprint 13 pp., 18 refs. Omsk, 1928. (With a Summary in English.)

Observations on the bionomics of *Hylemyia antiqua*, Mg., and *Eumerus tuberculatus*, Rond., which are the only flies recorded from various parts of the Omsk region as serious pests of onions, were made in 1927 and 1928.

In 1927 the first adults of *H. antiqua* were noticed on 3rd May and were on the wing till the middle of June, the mass flight occurring in the second half of May. In 1928 the first adults emerged as late as 23rd May, evidently owing to cold and rainy spring. In 1927 the first eggs were noticed by the end of May ; they were laid in small batches between the old scales of onions or on the ground near the plants. Each female may lay from 50 to 60 eggs, which hatch in 5 or 6 days. The larvae were very numerous between 12th and 30th June. The larval stage lasted about 2 weeks, and the pupal stage about 9 days, but the development of any stage is retarded by cold. The manner in which the larvae mine in the onions is fully described. In the Omsk region this fly has two full generations a year and sometimes a partial third. In 1927 the flight of the second generation began on the 24th of June. Oviposition occurred in the first half of July, and the larvae appeared about the middle of the month. The generations

overlap, egg, larvae and pupae being found throughout the whole summer. Hibernation takes place in the pupal stage in the soil near the food-plants ; experiments showed that the depth at which the pupae occur has no effect on the emergence of the adults. Ploughing the pupae deep into the soil is therefore ineffective as a control measure.

Eumerus tuberculatus is usually confused with *E. strigatus*, Fall., but all the flies of this genus found on onions in 1927 and 1928 were apparently *E. tuberculatus*, according to the description given by Collin [*R.A.E.*, A, viii, 332]. This fly hibernates in the larval stage in infested onions remaining in the soil under snow. In the spring, the larvae feed on the bulbs for a time and then pupate either in the upper layer of the soil or in the neck of the bulb ; by that time the latter is completely rotten as a result of infestation. The pupal stage lasts about two weeks. In 1927 the first adult was found on 30th May. Oviposition begins in the middle of June, the eggs being laid in small batches or singly on the ground among the onions. Humidity with a moderately high temperature is very favourable for the development of the larvae. In the Omsk region *E. tuberculatus* has two full generations a year and a partial third. Larvae of the first generation appeared at the end of June and were numerous in the middle of July. All the stages were found till the beginning of October, the second mass flight occurring at the end of August. Observations showed that in many case *E. tuberculatus* heavily infested onions independently of *H. antiqua*; it is therefore a serious primary pest of onions, and does not merely feed on rotten bulbs.

H. antiqua was more numerous in onions grown during the first half of the summer, and *E. tuberculatus* in those grown later, and as there exists a direct correlation between late planting and the percentage of infestation, early planting is recommended as the best remedial measure against both flies.

[Beĭ-Bienko (G. Ya.).] **Бей-Биенко (Г. Я.). Insects injuring Root-crops in the Omsk Region.** [*In Russian.*]—*Trud. sib. Inst. Sel. Khoz. Lesovod.*, x, reprint 26 pp., 26 refs. Omsk, 1928. (With a Summary in English.)

From 1926 to 1928 special observations were made in the Omsk region on insects attacking cruciferous root-crops, beets and carrots, as these crops are largely cultivated in western Siberia for fodder. In all, 46 species are recorded from various parts of the region.

Brevicoryne brassicae, L., attacks the leaves and flowers of crucifers. *Eurydema ornatum*, L., which infests the leaves, has two generations a year in western Siberia, of which the second is only a partial one. In 1928 oviposition began on 26th May ; the larvae first appeared on 17th June and occurred on cruciferous crops and weeds as late as the beginning of October. This bug hibernates in the soil in the adult stage.

The Elaterids, *Selatosomus latus*, F., and *S. spretus*, Manh., are serious pests of cruciferous crops, beet and carrot. The damage done by *Entomoscelis adonidis*, Pall., is slight. In the Omsk Government this beetle has at least two generations a year, the adults appearing at the end of May and beginning of June, and again at the end of August and beginning of September. Hibernation occurs in the adult stage, but the occurrence of larvae on cruciferous weeds as early as in the second half of May indicates that some individuals hibernate in this stage. *Chaetocnema concinna*, Marsh., infests the seedlings of

beets in large numbers in the second half of May and in June. *Psylliodes cupreata*, Duft., attacks both beet seedlings and young shoots of cultivated crucifers. For the control of these two pests, the destruction of cruciferous weeds and *Chenopodium album* is recommended; beet should not be grown near crucifers and should be planted when the two pests are less active. *Phyllotreta nemorum*, L., *P. vittula*, Redtb., and *P. cruciferae*, Goeze, seriously injure the young shoots of crucifers. The damage caused to beets by *Cassida nebulosa*, L., is insignificant, as the larvae attack the plants in June when they are already strong enough to be able to recover from the injury.

Barathra brassicae, L., is not of great importance. In 1928 the first batches of eggs were found on 28th June; the larvae appeared on 4th July and attacked the leaves of beets and crucifers till the end of September, the majority pupating at the beginning of October. *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), which attacks crucifers, has three generations in a year in the Omsk region. Hibernation occurs in the pupal stage, and the adults emerge in May or June.

Phorbia (*Hylemyia*) *brassicae*, Bch., is a serious pest of cultivated crucifers, infesting the roots and sometimes the base of the stems. The adults emerge from the hibernating pupae in the second half of May. In 1928 full-grown larvae were found by the end of June, when nearly all the adults had disappeared. The resulting flies appeared in the second half of July. In the autumn adults, larvae and eggs occurred as late as the beginning of October. An examination of turnips in the autumn showed that 90 per cent. of the crop was heavily damaged by this fly. *P.* (*H.*) *floralis*, Fall., chiefly attacks cabbage and only slightly damages cruciferous root-crops.

Athalia colibri, Christ (*spinarum*, F.) was especially abundant on turnips in July and August of 1928, when the larvae destroyed 90 per cent. of the leaves. The adults appeared in June, and those of the second generation in August and September.

[Nikitin (I. V.).] **Никитин (И. В.). Poisoned Baits in the Control of** *Euxoa segetum*, **Schiff.** [*In Russian.*]—*Bul. Ivanivsk. dosv. selektz. Sta.* [*Bull. Ivanovsk Exptl. Select. Sta.*], pt. 8, pp. 58–70, 1 ref. Okhtirka, August 1927.

Euxoa segetum, Schiff., caused considerable damage to winter crops in the Ukraine in the autumn of 1923 and heavily infested sugar-beet in the summer of 1924. The weather of the second half of the summer was very favourable to the development of the second generation, and poisoned baits were applied in the middle of August. They consisted of beet leaves and roots, cut in half or chopped, or cakes made of bran, dipped in a mixture of Paris green or sodium arsenite and diluted molasses. The results obtained were very satisfactory, 60–100 per cent. of the larvae being killed. Chopped roots are more effective than bran cakes, as the latter soon dry and cease to attract the larvae.

In 1925 *E. segetum* was not abundant owing to unfavourable weather, and its development was retarded, the larvae of the second generation appearing only in the beginning of September. Winter wheat was sprouting at this time, but it was protected by spraying with Paris green at the rate of about 1 oz. to 1½ oz. lime and 8 gals. of water. In 1926 the moth occurred in large numbers, the first generation considerably damaging sugar-beet, and the second infesting winter wheat. The

young larvae evidently prefer beet leaves to bait, as a single application of the latter killed only about 30 per cent. Spraying the beet at the period when the larvae feed on leaves would be very effective. The control of the second generation with baits was as effective as in 1924, nearly 100 per cent. of the larvae being killed. The best time for setting out the bait is immediately after sowing and before the appearance of the young shoots. Deep furrows ploughed along the edges of fields with baits placed in them at intervals are superior to trap-trenches for preventing the migration of the larvae.

[Gusev (V. I.).] **Гусев (В. И.). Beneficial Insects occurring on Trees infested with Bark-beetles. (Preliminary Report.)** [*In Russian.*]—*Izv. Leningr. Lesn. Inst.*, xxxvi, pp. 133–153, 14 refs. Leningrad, 1928. (With a Summary in German.)

This is a list of numerous insects of various orders recorded from forests in the Ul'yanovsk and Samara Governments, where they occurred on trees infested by various bark-beetles and in galleries made by the latter. In some cases notes are given on their morphology, biology and seasonal distribution, and whether or not they were predacious on the bark-beetles with which they were associated.

Ozols (E.), Zirnits (J.) & Brāmanis (L.). **Report of the Latvian Institute of Plant Protection for 1927-28.** [*In Lettish.*]—11 pp., 1 fig. Riga, 1928. (With Summaries in English.)

A short account is given of the action of arsenicals on *Cassida nebulosa*, L. The highest mortality was obtained by dusting with calcium arsenate, 94·7 per cent. of the insects being dead by the seventh day. A 1 per cent. spray of the same insecticide only killed 70 per cent. after 21 days. A 1 per cent. spray of lead arsenate killed 80 per cent. after 7 days, but a 0·5 per cent. spray only killed 30 per cent. after 22 days.

In experiments for the control of Aphids it was found that sprays of lime-sulphur (10° Bé.) or of sulphates of iron or copper up to 10 per cent. do not kill the hibernating eggs. These were killed in a fumigation chamber with hydrocyanic acid gas at the rate of 20–25 gm. potassium cyanide to 1 cu. m. space and an exposure of one hour at a temperature of 7° C. [44·6° F.]. With 30 gm. potassium cyanide they were killed in 30 minutes.

A short account is given of the distribution of larvae of *Hylobius abietis*, L., in the trunks of pines. They are most numerous (30–34 per cent.) at the base of the horizontal roots, especially those up to 2 inches in diameter; only 2 per cent. occur in the trunk above the ground. *Hylotrupes bajulus*, L., has increased in wooden buildings, the damage in some cases necessitating their abandonment.

The pests of cultivated plants recorded during 1927 include *Aphthona euphorbiae*, Schr., *Phaedon cochleariae*, F., *Cassida nebulosa*, L., *Incurvaria capitella*, Cl., *Chlorops taeniopus*, Mg., *Trioza viridula*, Zett., *Piesma maculata*, Lap., and *Kakothrips pisivorus*, Westw. (*robustus*, Uzel).

Waterston (J.). **Note on extensive Damage to Apples caused by the Dock Saw-fly** (*Ametastegia glabrata*, **Fall.**).—*Entomologist*, lxi, no. 787, p. 266, 3 refs. London, December 1928.

Severe injury to apple by *Ametastegia glabrata*, Fall., is reported from a small orchard in Surrey where 25 per cent. of the crop was rendered unsaleable owing to the boring of larvae into fruit; only a small percentage of the fruit fell, and the damage was not detected until the crop was gathered. The severity of the attack is thought to have been due to the fact that the trees in the orchard were in their second or third year of bearing and also probably to a lack of attention to the clearing of the undergrowth. The habits of this sawfly have been discussed [*R.A.E.*, A, v, 241, 346; xii, 284], but it has not previously been realised that under certain conditions it may cause very severe loss.

Adkin (R.). **Notes on the Genus** *Hyponomeuta*. **With special Reference to** *H. cognatellus*, **H.,** *H. padellus*, **L., and** *H. malinellus*, **F.**—*Proc. S. Lond. Ent. Nat. Hist. Soc. 1927-28*, pp. 48–54, 3 pls. London, 1928.

The bulk of the information in this paper has already been noticed [*R.A.E.*, A, xvi, 622].

Dieuzeide (R.). **Contribution à l'étude des néoplasmes végétaux. Le rôle des pucerons en phytopathologie.**—*Actes Soc. linn. Bordeaux*, lxxxi, reprint 243 pp., 64 figs., 31 pp. refs. Bordeaux, 1928.

This study of vegetable neoplasms and the insects that cause them, though approached primarily from a medical and biological standpoint, contains an account of Aphids, their systematic position, general anatomy, and method of inserting the stylet, and the cellular reactions resulting from their punctures. Vegetable tumours and animal cancers are compared and discussed, and the part played by Aphids in the transmission of plant diseases is indicated. After a general study on the structure of Aphid galls, those occurring on *Pistacia*, poplar and elm are dealt with individually in detail, together with the injury caused to apple by *Eriosoma lanigerum*, Hausm., to the vine by *Phylloxera*, and to conifers by *Chermes*. The latter part of the work deals with the process of gall formation, and an account is given of a few inconclusive experiments in artificial gall production.

Much remains to be elucidated in the study of gall-forming Aphids, the recent discovery that subterranean forms of certain species live on plants quite distinct from the principal food-plant opening up a fertile field for further biological study. Among the large number of works cited, many are little known owing to publication in a foreign language.

François (M.) & Séguin (L.). [**Examination of Insecticides.**]—*Ann. Falsif. Fraudes*, March 1927. (Abstract in *Ann. Igiene*, xxxviii, no. 11, pp. 930–932. Rome, November 1928.)

This paper describes methods for analysing commercial insecticides containing arsenicals, sodium borate, or paradichlorobenzene.

ALAGNA (N.). **Relazione tecnica e finanziaria del Consorzio Antidacico Obbligatorio di Calatafimi.** [Technical and financial Report of the Compulsory Association against the Olive Fly at Calatafimi.]— *Rinnovamento econ.-agrar.*, xxv, no. 5, pp. 122–127. Trapani, November 1928.

Sweetened arsenical baits in dishes or on bundles of twigs were used in 1928 in Sicily against the olive fly [*Dacus oleae*, Gmel.], 54,906 olive trees being protected at a cost of less than a penny a tree. Injury by the fly was slight, though this was not wholly due to the measures taken, as the general infestation was small.

JANCKE (O.). **Das Verhalten der Blutlaus gegenüber verschiedenen Kernobstgewächsen und über einige ungewöhnliche Befallstellen an Aepfeln.** [The Behaviour of the Woolly Aphis towards various Pip Fruits and Notes on unusual Places of attacking Apples.]— *Angew. Botanik*, x, 1928, pp. 197–207, 5 figs. (Abstract in *Centralbl. Bakt.*, (2) lxxvi, no. 15–24, pp. 411–412. Jena, 13th December 1928.)

Experiments were made with the woolly aphis [*Eriosoma lanigerum*, Hausm.], which occurred in large numbers during the winter of 1926–27 on *Cotoneaster horizontalis* near Dortmund, to ascertain the possibility of its migrating to plants closely related to apple. It was found that colonies could be established on *C. acutifolia* as well as on *C. horizontalis*. On the latter, the Aphid is able to pass the winter on the branches and roots. The Aphids survived for 6 weeks on *C. humifusa*, but did not become established. *C. integerrima* and *Mespilus* are not apparently suitable, as only a few Aphids survived on them. Young individuals are more adaptable to new food-plants than old ones, and the latter only survived on *C. horizontalis*. The experiments showed also that there is no question of specialised races of the Aphid occurring on various trees, and this is also supported by morphological investigations.

As a rule the Aphids only become established on the branches and trunks of apple, but have frequently been observed on the root-collar and occasionally on the roots near the soil surface. It is evident that the Aphid can establish itself on any part of the apple tree, including fruit and leaf stems and the fruit itself.

CREBERT (H.). **Der Blattrandkäfer** (*Sitona lineata*) **als Hülsenfruchtschädling.** [*S. lineata* as a Pest of Pulse Crops.]—*Z. PflKrankh.*, xxxviii, pt. 11–12, pp. 322–326, 2 figs. Stuttgart, 1928.

The extensive pulse crops in Bavaria have been seriously damaged by *Sitona lineata*, L. In some cases the plants were defoliated and killed. This weevil has only been found on leguminous plants, and contrary to the observations of other workers, it was never found attacking any species of *Lupinus*, though these occurred in heavily infested fields. Of the various plants infested peas (*Pisum sativum* and *P. arvense*), vetch (*Vicia sativa*) and closely related forms are most heavily attacked; broad beans (*V. faba*) and *Melilotus alba* are also seriously injured. The only suitable remedial measures are those that improve the resistance of the plants, such as early and repeated hoeing.

Neuwirth (F.). **Die Kräuselkrankheit der Zuckerrübe.** [Curly-leaf of Sugar-beet.]—*Rdsch. Z. Zuckerind. čsl. Repub.*,1926, no. 4, p.14. Prague, 1926. (Abstract in *Z. PflKrankh.*, xxxviii, pt. 11–12, p. 335. Stuttgart, 1928.)

Curly-leaf of sugar-beet as occurring in the United States is briefly reviewed, in view of the importance of preventing the introduction of the transmitting agent, *Eutettix tenella*, Baker, into Europe. A similar curling of beet leaves has been observed in Bohemia, where the plants are heavily infested by *Cicadula sexnotata*, Fall., and also in Moravia.

Baudyš (E.). **Poškozené vikve bejlomorkou vikvovou.** [Seed Vetch attacked by *Dasyneura viciae*, Kief.]—*Flugbl. Inst. Pfl Hyg.*, no. 43, 2 pp., 3 figs. Brünn, 1926. (Abstract in *Z. Pfl Krankh.*, xxxviii, pt. 11–12, p. 356. Stuttgart, 1928.)

A serious outbreak of the gall-midge, *Dasyneura viciae*, Kief., occurred on seed vetch in Czechoslovakia in 1925, resulting in deformed leaves and unopened flowers. In cases of severe infestation the plants should be mown and used at once as fodder ; otherwise the larvae will leave the plants to pupate in the soil. Less severely infested fields should be covered with kainit and well harrowed, so that as many larvae as possible come in contact with it. Fowls can also be used to destroy the larvae. All wild vetches should be destroyed.

Eidmann (H.). **Zur Kenntnis der Biologie der Rossameise** (*Camponotus herculeanus* **L.).** [On the Biology of *C. herculeanus*, L.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 229–253, 9 figs., 24 refs. Berlin, November 1928.

A long and detailed account is given of the bionomics of *Camponotus herculeanus*, L., and its varieties in Germany. One variety of this ant sometimes builds its nest in the ground, but the typical form apparently only builds in wood, preferably in conifers. Where the nests occur in tree trunks, this ant may occasionally become of economic importance.

Bremer (H.). **Grundsätzliches über den Massenwechsel von Insekten.** [Conditions governing Outbreaks of Insects.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 254–272, 5 figs., 24 refs. Berlin, November 1928.

The factors influencing variations in the numbers of insects in a given locality are discussed. No new facts are propounded, nor is the existing knowledge on the subject reviewed, but an attempt is made to facilitate further study by discussing the basic theories and terminology, which are represented by mathematical formulae.

Martini (E.). **Ueber die Kettenlinie und die Exponentialkurve überhaupt als Bilder für die Abhängigkeit der Entwicklungsdauer von der Wärme.** [On the Chain Line and Exponential Curve in general as Examples of the Influence of Warmth on the Duration of Development.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 273–284. Berlin, November 1928.

The author discusses and criticises at length the theories expounded by Janisch [*R.A.E.*, A, xiv, 501] on the mathematical expression of the influence of external factors (temperature, in this instance) on the development of insects.

Hülsenberg (—). **Versuche mit Calciumcyanid zur Bekämpfung von Gewächshausschädlingen.** [Experiments with Calcium Cyanide for the Control of Greenhouse Pests.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 285–315, 1 fig., 8 refs. Berlin, November 1928.

For the control of greenhouse pests calcium cyanide provides the best method of hydrocyanic acid gas fumigation and is cheaper than nicotine preparations. In the experiments described, flakes (50·27 per cent. NaCN) and granules (45·02 per cent. NaCN) were mainly used. The flakes are superior in action, but the slight difference in the content of active HCN is not sufficient to account for this ; it is probably due to the fact that the gas is given off more quickly owing to the greater surface. Both plants and insects react differently to the fumigation, and further work to ascertain the best dosages under varying conditions is necessary. At present it is recommended that a preventive fumigation should be carried out at 14-day intervals at the rate of 0·5 gm. to the cubic metre of air space. Fumigation should be done at night, and the houses properly ventilated next morning. Where necessary, the intervals between fumigation can be reduced to 3 days. Extensive tables are given showing the results of fumigation on different plants and insect pests. In some cases the value of the fumigation is greatly increased if it is followed by nicotine fumigation, using a comparatively low concentration of the latter.

Rasch (W.). **Der augenblickliche Stand der Ausbreitung der Blausäure in der Schädlingsbekämpfung.** [The present Status of Hydrocyanic Acid in the Control of Pests.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 316–324, 1 fig. Berlin, November 1928.

This is a general review of the uses of hydrocyanic acid gas in its various forms in different parts of the world.

Bodenheimer (F. S.) & Klein (H. Z.). **Beiträge zur Kenntnis von *Marseulia dilativentris* Reiche. (Col. Chrysom.)** [A Contribution to the Knowledge of *M. dilativentris*, Reiche.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 343–355, 4 figs. Berlin, November 1928.

The original description of *Marseulia dilativentris*, Reiche, is quoted. This Galerucid occurs in various localities in Palestine, particularly near the mountain regions. The adults appear in large numbers about 6 weeks after the first early rains, *i.e.*, at the beginning of December. Oviposition probably occurs in cracks in the soil, but it has not been observed under natural conditions. In captivity the eggs were readily laid even in small containers. On the average about 20 eggs are laid by one individual. Oviposition probably begins about the end of December and continues until the middle of February. None of the eggs hatched in captivity, but it is thought that under natural conditions they hatch in a few weeks and that the larvae aestivate until the following October, when development is rapid after the rains begin, the adults emerging in December. Pairing was observed in nature from the end of December to the end of January.

The beetles attack a variety of plants, the leaves of which they skeletonise ; barley, wheat and oats are preferred, though leguminous plants, root crops and vegetables are also infested. A list is given of the plants attacked in captivity.

In view of the small acreage of cultivated cereals in Palestine, control of this pest is not economically practicable. Minor experiments with sprays of Urania green gave unsatisfactory results.

Séguy (E.). **Etude sur le** *Pollenia hasei.*—*Z. angew. Ent.*, xiv, pt. 2, pp. 369–375, 10 figs. Berlin, November 1928.

The known larvae of flies of the genus *Pollenia* are parasites of earthworms, but the occasional great abundance of certain species and the polymorphism of the adults suggest that they may have other hosts. *P. hasei*, sp. n., was found in Spain in association with *Sesamia vuteria*, Stoll *nonagrioides*, Lef.). A key to the species of *Pollenia* is given.

Schimitschek (E.). *Clytus lama* **Muls. (Cerambycidae), ein bis jetzt wenig beachteter technischer Schädling an Nadelhölzern.** [*C. lama*, Muls., a little-known Pest of Coniferous Timber.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 384–388, 2 figs. Berlin, November 1928.

The Cerambycid, *Clytus lama*, Muls., is recorded from Austria as infesting larches. Although it only attacks weak or dying trees, it is of considerable economic importance as the galleries, the construction of which is described, reduce the value of the wood. Preventive measures such as early removal (before April) of infested material are important. The only parasite found was *Ephialtes carbonarius*, Christ.

Steyer (–). **Epidemisches Auftreten des Hausbockes** (*Hylotrupes bajulus*, **L.) in Lübeck.** [An Outbreak of *H. bajulus*, L., in Lübeck.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 388–389. Berlin, November 1928.

Various public buildings in Lübeck have been seriously damaged by *Hylotrupes bajulus*, L., the larvae of which bore in the woodwork. Infestation chiefly occurs in the beams in the roof, particularly where these are very dry. The adults are also destructive and may even bore through lead. Similar damage has been recorded from Denmark. Fumigation with calcium cyanide is being tried.

Tempel (W.). **Speckkäferlarven als Holzzerstörer.** [Dermestids as Wood Destroyers.]—*Kranke Pflanze*, v, no. 11, pp. 185–187, 5 figs. Dresden, November 1928.

A short account is given of the serious damage caused by *Dermestes vulpinus*, F., to the woodwork of a barge. The cargo included cotton, bones, lead, etc. A large number of larvae and a few adults of *D. vulpinus*, F., were found under the boards, and numbers of adults of the Clerid, *Necrobia ruficollis*, F., were also present. Fumigation with hydrocyanic acid gas generated from Zyklon B at the rate of 2 volumes per cent. for 60 hours killed all the Dermestids though about 30 per cent. of the Clerids survived.

Sprengel (L.). **Untersuchungen über den Blutlausparasiten** *Aphelinus mali* **Hald.** [Observations on the Woolly Aphis Parasite, *A. mali*.]—*Anz. Schädlingsk.*, iv, pt. 12, pp. 151–160, 3 figs., 10 refs. Berlin, 1928.

A short preliminary report is given of the author's work on the rearing and establishment of *Aphelinus mali*, Hald., against *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm. The technique of rearing and the

habits of the parasite are described. It is being successfully liberated in the Rhine Palatinate, where its establishment and spread are favoured by climatic conditions. Though as a rule the spring emergence is ensured by storing branches with parasitised Aphids throughout the winter, the parasite is able to pass the winter successfully under natural conditions. From laboratory experiments it is evident that the adults may live for several days without food and suitable material for oviposition, but they oviposit as soon as they come in contact with the Aphids. The failure of the parasite in some districts is probably due to the number of generations being limited by the scarcity of the host.

KRAUSSE (A.). **Ein neuer Schädling an einjährigen Kiefern.** (*Tortrix politana* **Hw.**) [A new Pest of one year old Pines (*T. politana*, Hw.).]—*Forstarchiv*, iv, 1928, pp. 251–252, 1 fig. (Abstract in *Neuheiten Gebiete PflSchutzes*, 1928, no. 3, p. 80. Vienna, October 1928.)

Tortrix politana, Hw., usually living on blueberries and cranberries, attacked a large area of young pines in Silesia. The larvae spin a shelter in which they feed. Adults were on the wing from April to June and from August to September, larvae being found in July and September. The parasites, *Pimpla instigator*, F., and *Nemoriella floralis*, Fall., have been reared from this moth.

ECKSTEIN (—). **Neue Schädlinge an jungen Kiefern.** [New Pests on young Pines.]—*Deuts. Forstztg.*, xliii, 1928, pp. 665–666, 1 fig. (Abstract in *Neuheiten Gebiete PflSchutzes*, 1928, no. 3, p. 81. Vienna, October 1928.)

During September of 1927 young pines in Silesia were attacked by *Tortrix politana*, Hw. This pest is a general feeder, and the larvae usually live among the leaves of various weeds in pine forests.

RAMBOUSEK (F.). **Ueber die Felddrahtwürmer. I. Systematischer Teil.** [On the Field Wireworms. I. Systematic Part.]—*Z. Zuckerind. čsl. Repub.*, lii, pp. 393–402, 19 figs., Prague, 1928. (Abstract in *Neuheiten Gebiete PflSchutzes*, 1928, no. 3, p. 83. Vienna, October 1928.)

A key is given to 16 species of wireworms occurring in fields in Czechoslovakia, of which *Agriotes obscurus*, L., is the most serious pest of beet. *A. lineatus*, L., occurs in meadows and only sparsely on beet. The adults emerge at the end of the summer and hibernate in the soil, ovipositing in spring. *Athous niger*, L., is commoner on grain crops than on beet. The larvae of *Melanotus brunnipes*, Grm., also attack maize. Notes are given on the technique of rearing *Agriotes ustulatus*, Schall., and *Brachylacon murinus*, L.

PROSCHKY (H.). **Die Vertilgung des Rübenkäfers.** [The Destruction of Beet Beetles.]—*Wiener landw. Ztg.*, lxxviii, 1928, pp. 186–188, 3 figs. (Abstract in *Neuheiten Gebiete PflSchutzes*, 1928, no. 3, p. 85. Vienna, October 1928.)

Phosphuga (*Silpha*) *atrata*, L., is said to be a serious pest of young beet plants in Austria [but *cf. R.A.E.*, A, xvi, 59, etc.]. During a

heavy infestation the plants are entirely defoliated within 2–3 hours. After the application of a spray of 50 lb. barium chloride, 20 lb. wheat flour and 100 gals. water, no living larvae were found.

SCHIMITSCHEK (E.). **Fichtengespinstwespe.** [The Spruce Spinning Sawfly.]—*Wiener allgem. Forst- u. Jagdztg.*, xlvi, 1928, p. 100. (Abstract in *Neuheiten Gebiete PflSchutzes*, 1928, no. 3, p. 85. Vienna, October 1928.)

Cephaleia abietis, L. (*Lyda hypotrophica*, Htg.) has been increasing in Moravia during the past four years, from 15 to 20 per cent. of the spruces having been defoliated. Its parasites also appear to have increased. Where parasites are not numerous, dusting with arsenicals from aeroplanes is recommended.

MIESTINGER (K.). **Ueber die gemeinsame Anwendung von Schweinfurtergrün und Tabakextrakt zur Traubenwicklerbekämpfung.** [On the Control of Vine Moths by the Combination of Paris Green and Tobacco Extract.]—*Allg. Wein-Ztg.*, 1928, no. 10, reprint 2 pp. Vienna, 25th May 1928.

Experiments in Austria against the vine moths [*Polychrosis botrana*, Schiff., and *Clysia ambiguella*, Hb.] by means of a combined spray of Paris green and tobacco extract are briefly described. The spray tested consisted of Bordeaux mixture containing 0·15 per cent. Paris green against the spring generation, or 0·2 per cent. against the summer generation, to which is added an amount of quick lime equivalent to five times the weight of the Paris green. The tobacco extract was added to this mixture at the rate of 2·5 per cent.

The combined spray has also been used in Germany with satisfactory results. The addition of tobacco extract, particularly against the spring generation, is only necessary if the larvae have already begun spinning, as the arsenical does not readily penetrate the webs. Against the summer generation it should be applied with the second Paris green spray, or if arsenical dusts are used, before the second dust.

In the experiments discussed no plant injury resulted from the application of the combined spray.

[VUKASOVIĆ (P.).] **Вукасовић (П.). Observations on** *Lecanium corni* **on Plums.** [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda*, vi, no. 10–12, reprint 29 pp., 10 figs., 4 refs. Belgrade, 1928. (With a Summary in French.)

An outbreak of *Lecanium corni*, Bch., occurred in 1926 in central Serbia, and serious damage was caused to plum orchards, which are of great economic importance in that country. Observations in June and July 1928 showed that *L. corni* has only one generation a year. The adults hibernate on the food-plants, and only occasionally, when the trees are very young, in the upper layer of the soil near the trunk. Early in the spring they move to the upper branches. Oviposition occurs in the middle of June, and a female may lay from 1,000 to 2,000 eggs. These hatch in about two weeks, and the young Coccids feed on the sap of the leaves until late in the autumn, when they enter hibernation.

Four or five species of Chalcid parasites were found in central Serbia, of which *Eucomys swederi*, Dalm., appears to be the most important. The larvae are gregarious and develop in full-grown hosts, under the scales of which they pupate, the adults emerging in June. *L. corni* is also attacked by the larvae of various Coccinellids, especially of one unidentified species that appeared in June and fed on the eggs under the scales. Dormant sprays of carbolineum (8–10 per cent.) are effective in controlling this Coccid, but are too expensive for general use. Fumigation of the infested trees is suggested.

[Vukasović (P.).] **Вукасовић (П.). Contribution to the Study of Entomophagous Insect Parasites.** [*In Serbian.*]—*Glas Srpske Kral. Akad.*, cxxxi, pp. 45–72, 6 refs. Belgrade, 1928. (With a Summary in French.)

This is an account of observations made in Serbia since 1924 on entomophagous insect parasites. Tables are given showing the hosts, their parasites, the stages that the latter attack and the time when they were observed.

The relation between the development of the parasites and their hosts is discussed in detail. The problems of host-selection by insect parasites are very complex. Though in some cases they appear to be limited to one or a few hosts, it is difficult to explain how this specialisation was evolved, and further work may show that it does not, in fact, occur. As regards ectoparasites, experiments indicated that the larvae can develop on any host, provided that their mandibles can pierce its integument. The causes that may have produced the simplified structure of parasite larvae and the evolution of parasitic habits are also discussed.

Roubaud (E.). **Biological Researches on *Pyrausta nubilalis* Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 1–40, 11 figs., 2 refs. Chicago, Ill., 1928.

In the course of two years' investigations on the biology of *Pyrausta nubilalis*, Hb. (European corn borer) in France, the author's researches were based on the fact that, whereas in the infested areas in Europe the borer is usually confined to a few crops such as maize, hemp, millet, *Sorghum* and hops, and has but little economic significance, in the comparatively newly infested regions in America, the insect causes severe infestation in a great variety of field and garden crops. Parasites do not exert in America the stabilising influence on the borer that they do in Europe, but, though this may explain the rapid spread of the borer and the severity of its attacks, it seems doubtful whether it is the sole explanation. Even in Europe the parasites cannot control intense infestations. Nor does the difference in climatic conditions seem sufficient to account for the difference in infestation. It is obvious that in France the common mugwort (*Artemisia vulgaris*) is a very important food-plant of *P. nubilalis*; in some localities the infestation is intense and strictly limited to this plant, vegetables, flowers and other wild food-plants in the vicinity remaining uninjured, and undoubtedly it represents the fundamental food-plant in many regions in Europe where maize in not grown.

In experiments to determine the effect of infestation on *A. vulgaris*, it was observed that plants already well-developed supported infestation

very well and did not seem to suffer even when dozens of borers were present in the stems and larger branches; only plants excessively infested and growing under unnatural conditions succumbed to the attack. Because *A. vulgaris* can withstand a heavy attack, can react with the formation of new sprouts at the attacked points, and grows in the same place year after year, it is more suitable than maize for the permanent development of *P. nubilalis*. The moths exhibit a marked preference for mugwort for oviposition, and the percentage of larvae that complete development in it is higher than in maize [*R.A.E.*, A, xvi, 53]. It still remains to be proved whether *P. nubilalis* in America would be as definitely attracted to mugwort as in Paris. The author has attempted to solve this question experimentally, using moths bred from a consignment of several thousand larvae of *P. nubilalis* from Canada. The plants were arranged in a cage, and, although definite results cannot yet be presented, a preference for the mugwort plants could be observed, and in about 4 months all the mugwort plants had withered and dried up while the maize plants remained healthy. In the author's opinion, mugwort, the preferred food-plant of *P. nubilalis*, does not represent an extra reservoir that should be destroyed as part of the campaign against the borer, but acts as a regulator, which, properly employed, would maintain the original food relationship and prevent polyphagy. When, in certain districts of France and southern Europe, infestation is found on maize and mugwort simultaneously, local conditions are rendering the protection afforded incomplete. There are other weeds in America, such as *Xanthium* and *Polygonum* spp., that seem to suffer as intense infestation as mugwort; severe eradication measures have been undertaken in the past against these weeds, but it is quite possible that they may play the same protective rôle towards maize as mugwort does. This theory should be tested by field experiments.

The susceptibility of five different French varieties of maize to infestation by *P. nubilalis*, which has been tested experimentally (the method being described), is discussed in detail, and shows considerable variation. There is also evidence that the maize plant offers active resistance to the borer through some internal biological reaction. The maximum larval development corresponds to a certain average initial infestation which, in the experiments was about 20 larvae to a plant. In 35 experiments, involving over 200 maize plants of different varieties, not more than 4 larvae developed in any plant. This is also quoted as the maximum natural infestation in southern Germany; in the Danube valley and in the United States the degree of infestation is much higher and sometimes exceeds 30 to 40 borers to a plant. This indication of physiological resistance affords an explanation of the differences in the severity of infestation and damage by the borer, and renders possible the organisation of methods for opposing the threatened extension of *P. nubilalis* in the most heavily attacked regions. If, as these observations indicate, the varieties of maize grown in the United States and Canada are more favourable for the development of *P. nubilalis* than are the European, and particularly the French varieties, it is obvious that the American ones should be replaced by more resistant European strains.

Investigations have also been made into the summer and winter torpor of larvae of *P. nubilalis*, which in part have been previously recorded [*R.A.E.*, A, xvi, 300]. The factors influencing the diapause in the larval life, which results in the production of sometimes one and

sometimes two generations a year, have not yet been definitely ascertained, but the author is convinced, after ten years' research, that it is dependent upon a specific intoxication caused by excretions from the metabolic activity, especially uric acid. He discusses at greater length the effect of anhydrobiosis and of athermobiosis as essentials for reactivating the fifth instar larvae so that they are able to pupate, the effect being purgative and enabling the larva to get rid of toxic secretions that cause physiological inertia. Putting these theories to practical use, it is possible to retard the period of pupation and reproduction in the spring by drying the stalks and stubbles of plants containing borers, or accelerate it by systematic watering. If dried stalks are ploughed under in the spring, a humid environment is produced which favours the rapid development of the larvae. If, however, the stalks are spread out on the surface of the ground, conditions of anhydrobiosis are produced that retard larval development. The reactivating conditions of athermobiosis can be eliminated by placing the dry infested stalks in compost piles or silos ; the fermentation will maintain constant humid heat unfavourable to reactivation or development of the borers. Intermixture with barnyard or horse manure will aggravate these conditions ; it should be remembered that they are only effective if applied prior to the reactivation of the larvae by the cold of autumn and winter and if the larvae have not suffered summer torpor or reactivation by anhydrobiosis. In regions where there are two generations in a year, the summer campaign against the borer may be conducted by preventing the reactivating effects of anhydrobiosis on the larvae during warm, dry weather in this manner. If, however, these measures have not been taken early enough, the stalks should be kept dry as described above, so that rehydration cannot take place ; the second generation will thus appear so late that it cannot be very vigorous.

Insecticides have been tried in America against *P. nubilalis* without much success ; they can be used only on the eggs and young larvae before they penetrate the stalks. Acting on the fact that larvae, when placed on a dry absorbent or porous surface, dehydrate rapidly, become sluggish and die, experiments have been conducted in France with powders, which it was hoped would produce the same effects, and these have entirely confirmed expectations. The powders used were merely absorbent and not necessarily poisonous ; of calcium fluoride, calcium carbonate, calcium sulphate, Paris green mixed with 99 per cent. road dust and Stoxal mixture with a trioxymethylene base, the first two seemed to be the most effective. The duration of the protective action of these powders has not yet been tested. They can easily be dusted over large maize areas, and aeroplanes might be useful for the purpose.

METALNIKOV (S.) & CHORINE (V.). **The Infectious Diseases of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 41–69, 6 figs., 56 refs. Chicago, Ill., 1928.

The experimental work described in this paper forms part of a complete study of the diseases of *Pyrausta nubilalis*, Hb. European corn borer). The larvae examined included thousands collected from plants of mugwort (*Artemisia vulgaris*) near Paris, many of these being diseased or dead from bacterial infection, 1,000 from Canada, more than 50 per cent. of which were infected with micro-organisms, a numerous collection

from eastern Europe, many of which were infected with bacteria and fungi, and about 350 from Hungary, over 90 per cent. of which died from infectious diseases. Sometimes all the bacteria found were of one species; at other times two or more species were associated in the same larva.

The bacteria studied include three very virulent ones, two of which, *Coccobacillus ellingeri*, sp. n., and *Vibrio leonardi*, sp. n., found in the Paris specimens, are described and their morphology and cultural characteristics discussed. The former killed larvae of *P. nubilalis* and of *Galleria mellonella*, L., by inoculation in from 2 to 12 hours, and corn borer larvae infected *per os* generally died within 2 days. The latter killed by injection within 24 hours and *per os* within a few days. The third virulent bacterium was isolated from the Canadian consignment and readily infects corn borer larvae *per os*. Seven less important bacteria have been isolated from the Paris larvae; their biological characters are briefly recorded in a table, but it has not been possible to accomplish a successful inoculation *per os*. Larvae of *P. nubilalis* have also been experimentally infected with several bacteria isolated from other insects; one of these, *Bacterium galleriae* no. 2, has proved exceptionally virulent. By adding a culture of this bacterium to the food of the larvae, from 95 to 100 per cent. mortality was obtained. Neither *C. ellingeri* nor *V. leonardi* form spores, and their vitality is therefore limited, but both *B. galleriae* no. 2 and the Canadian bacterium do form spores and therefore have a practical advantage; experiments show that old cultures of *B. galleriae* no. 2, consisting only of spores, are as virulent as fresh cultures.

The aetiology of these diseases is discussed. It was found that the rapidity of infection is influenced by the temperature; it is very great at 37° C., but diminishes with decreasing temperature; the mortality of the larvae is constant between 20 and 37° C. [68 and 98·6° F.]. Passage of the bacteria through larvae of *P. nubilalis* constitutes a valuable means of maintaining their virulence for a long period. Insect blood contains very little oxygen, and experiments showed that the absence of free oxygen in the culture-medium stimulates the virulence of the bacteria. The hydrogen-ion concentration of the culture medium has much influence on the bacteria; pH 7·2 is the optimum for *Coccobacillus ellingeri*.

Metalnikov (S.), Ellinger (T.) & Chorine (V.). **A new Yeast Species, isolated from diseased Larvae of** *Pyrausta nubilalis* **Hb. A preliminary Note.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 70–71, 1 fig. Chicago, Ill., 1928.

The micro-organism pathogenic to larvae of *Pyrausta nubilalis*, Hb., recorded in the preceding paper from a Canadian consignment of larvae, is described as *Mycoderma clayi*, sp. n. The morphology of the organism indicates that it is a typical yeast, which grows well on artificial culture-media, particularly malted water. Larvae of *P. nubilalis* may be infected by injection of the yeast cells into the blood, where they multiply rapidly, producing septicaemia and causing the death of the larvae in 2–5 days. In artificial culture-media the yeast degenerates and develops a mycelium; the formation of spores has never been observed. The organism constitutes an intermediary form between the typical yeasts and the higher fungi.

Metalnikov (S.) & Toumanoff (K.). **Experimental Researches on the Infection of** *Pyrausta nubilalis* **by Entomophytic Fungi.**
Toumanoff (K.). **On the Infection of** *Pyrausta nubilalis* **Hb. by** *Aspergillus flavus* **and** *Spicaria farinosa.*—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 72–73, 4 refs., & pp. 74–76, 4 figs. Chicago, Ill., 1928.

The information contained in the first of these papers has already been noticed [*R.A.E.*, A, xvi, 324].

A study has been made of the manner of infection of larvae of *Pyrausta nubilalis*, Hb., with the fungi, *Aspergillus flavus* and *Spicaria farinosa*. The author considers that infection through the skin is probably the commonest form among caterpillars. Infection was observed in 3–5 days after the spores were placed on the skin of the larvae, which died a few days later. The growth of the filaments is very rapid ; they gradually invade the intestinal tract, and by the time the larva dies, the whole body is filled with them. The infection of the larvae through the skin does not require special humidity, and the fungi develop within a wide range of temperature (18–30° C. [64·4–86° F.] in the present experiments).

Paillot (A.). **On the natural Equilibrium of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 77–106, 22 figs., 4 refs. Chicago, Ill., 1928.

A brief account of the author's researches on the parasites and predators of *Pyrausta nubilalis*, Hb., in the central eastern region of France has already been noticed [*R.A.E.*, A, xvi, 472]. The general technique employed in the study is described, and a map shows the territory examined. The Ichneumonid, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht. (previously recorded as *E. crassifemur*, Thoms.) emerges towards the end of April, that is, almost three months before *P. nubilalis*, so that eggs are probably deposited on another host. The adults are not numerous in the maize fields until the first corn borer larvae are infesting the stalks. The ovipositor is thrust through the maize stalk and into the body of the host. The usual number of eggs in one host larva is 3 or 4, but 10 or 15 may sometimes occur. Many of the eggs die in the host, probably owing to their envelopment by blood cells. This relative immunity of the host may imply that the parasite is as yet not thoroughly adapted to it, the principal host being probably one of the Microlepidoptera on wild plants. The full-grown larva spins a very resistant cocoon beside the remnants of the dead host. *Microbracon brevicornis*, Wesm., attacks full-grown larvae, paralysing them and depositing eggs in masses on the skin. The development of the parasite is rapid, depending largely on the temperature ; development from egg to adult has been observed in 14–22 days. Several factors, however, limit its spread so that it is no more important than *E. alkae* ; these include polyphagous habits, low fertility, difficulty of entering the maize stalks, and the fact that each female only parasitises a few corn borer larvae. The Tachinid, *Lydella senilis*, Mg., is more limited in its distribution than *E. alkae*, but the degree of parasitism ranges in both cases between 5 and 10 per cent. Only one parasite larva is found in each host, and the parasite probably depends on the presence of some unknown intermediary host. *Pimpla* (*Exeristes*) *roborator*, F., is an occasional parasite of *P. nubilalis*, the

female first paralysing the larva and then ovipositing on the skin ; the larva develops in 7 or 8 days and spins a cocoon near the dead host. This parasite may gradually become more important.

The influence of bacteria on the corn borer is discussed. *Bacillus sotto* and a bacillus from Spain, both pathogenic to the silkworm [*Bombyx mori*, L.], proved to have little effect. No diseases caused by filtrable viruses have as yet been found. A protozoon of the Microsporidian group, *Perezia pyraustae*, sp. n., has been found in the malpighian vessels and silk glands of the larvae. Its life-cycle is described ; it readily infects *per os* the larvae of *P. nubilalis*, and is also transmitted through the egg. This organism, though rather abundant in France, is not apparently of much importance in the destruction of the corn borer. A new flagellate, *Herpetomonas* (*Leptomonas*) *pyraustae*, sp. n., has been found in the malpighian vessels and alimentary tract of larvae of *P. nubilalis*, where it seems to live as a commensal rather than a parasite. The infection only reaches about 1 per cent., and attempts to infect the larvae artificially have proved unsuccessful.

Predators include the ant, *Lasius* sp., the lacewing, *Chrysopa vulgaris*, Schneider, the larvae of which suck the contents of the eggs and young larvae of *P. nubilalis*, and the mite, *Allothrombium fuliginosum*, Herm., which is probably somewhat less important. The exact reason for the high mortality among young larvae of *P. nubilalis* is not, however, known ; the influence of physical factors has never been demonstrated. The destruction of old maize stalks is considered the most important factor in controlling the spread of the moth.

Séguy (E.). **On the Generic Characters of the Genera** *Ceromasia* **and** *Lydella*, **and on the Identity of** *Lydella lepida* **Stein and** *senilis* **Meigen.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 107–108, 1 fig. Chicago, Ill., 1928.

In Stein's classification of the Tachinids of Central Europe [*R.A.E.*, A, xiii, 17], the genus *Ceromasia* includes several groups of Diptera ordinarily considered heterogeneous. Lundbeck separates the species of *Lydella* on the basis of certain characters, which, however, are indefinite, so that the distinction between the two genera is very difficult. This explains why *L. lepida* by Stein's dichotomic table, may be identified as *C. senilis*, Mg. ; Lundbeck has treated *C. lepida* of Stein (nec Meigen) as a synonym of *C. senilis*. The author has made dissections of the genitalia of several representatives of each of the two groups of Stein's *Ceromasia* ; the apparatus characteristic for the species of the group *Lydella*, including *sordidisquama*, Zett., *albisquama*, Zett., *senilis*, and *nigripes*, Fall., is distinct. It is, therefore, possible to unite the closely related forms of the genera *Ceromasia*, *Paraphorocera* and *Lydella* under the genus *Lydella* and thus to emphasise the specific identity of *Ceromasia lepida* (sensu Stein, nec Meigen) with *L.* (*Paraphorocera*) *senilis*.

Ellinger (T.) & Sachtleben (H.). **Notes on the Central European Parasites of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927-28*, pp. 109–133, 2 pls., 4 figs., 55 refs. Chicago, Ill., 1928.

Parasites of *Pyrausta nubilalis*, Hb. (European corn borer) collected in Europe in the course of these investigations are *Eulimneria* (*Limnerium*) *alkae*, sp. n. (previously recorded as *E. crassifemur*, Thoms.),

from Hungary, Jugoslavia, Rumania and Germany; *Microgaster tibialis*, Nees, from Germany; *Microbracon brevicornis*, Wesm., from Hungary, Rumania and Germany; *Angitia* (*Inareolata*) *punctoria*, Rom., from Hungary (*Inareolata* being a new name proposed for *Dioctes*, Forester nec Ménétriés); *Eulophus viridulus*, Thoms., from Hungary and Rumania; and *Lydella* (*Masicera*) *senilis*, Mg., from Hungary, Jugoslavia and Rumania. Descriptions of these species are given, with notes on their synonymy.

The central European region of corn borer infestation, which comprises the river system of the Rhine and the two big basins of the Danube and its tributaries, the central basin of Hungary and northern Jugoslavia and the lower basin of western Rumania, was chosen for these collections because it is climatically and agriculturally very similar to the Mississippi Valley.

Zwölfer (W.). **Corn Borer Controlling Factors and Measures in Southern Germany.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 135–142, 11 figs. Chicago, Ill., 1928.

The degree of parasitism of *Pyrausta nubilalis*, Hb., during 1927 in the upper Rhine Valley by *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., *Microgaster tibialis*, Nees, *Microbracon brevicornis*, Wesm., and an undetermined Tachinid was 0·79, 3·89, 0·05 and 0·01 per cent. respectively in 5,693 larvae examined, while 1·08 per cent. were infected by fungi. *Microgaster tibialis* destroyed as many as 11 per cent. of the larvae in some localities. The parasites emerge in April, the males first, though males and females occur in almost equal numbers, and lived for from 1 to 3 weeks in the laboratory. They did not oviposit on mature larvae of *P. nubilalis* nor on the larvae of other Microlepidoptera offered to them. It seems probable that there are two generations in a year, the first parasitising some other host than *P. nubilalis* that appears early in the season. The second generation also may develop on some other host, for although in 1926 practically all larvae of *P. nubilalis* were destroyed on an experiment farm, so that the parasites must all have been killed, in the following year the degree of parasitism was higher than before. The degree of parasitism evidently depends on the situation of the field; in a field adjacent to a pine forest, 5·85 per cent. of the corn borer larvae were parasitised, while in a field half a mile away the percentage was only 1·08. The larvae are attacked from late July to early August, while they are still boring in the tassel stalk of the maize and are accessible to the parasite. The development of the parasite larva is complete in late September or early October, when it leaves the host and spins a cocoon beside the remains of the dead borer.

The larvae of *Eulimneria alkae* leave the host larvae and spin their cocoons from late September to the end of November. These differ in size and colour; the author found the dark cocoons in maize stalks and the paler ones in the hibernating quarters of the borer, such as potato stems, etc. This parasite emerged in April, males and females being in almost equal numbers. Adults lived only 8 or 10 days in the laboratory, and did not oviposit on borer larvae placed in the cage. Probably an early generation occurs on another host.

In a consignment of larvae collected from Tours, 30 per cent. were found to be infested with *Macrocentrus abdominalis*, F. These parasite larvae hibernate in the host larvae, from 15 to 20 emerging from each

host and pupating in a common cocoon. All emerging from one host are of the same sex, probably being polyembryonic. The females are more numerous than the males.

Occasional predators observed by the author include a mite that destroyed the eggs, the ant, *Tetramorium caespitum*, Latr., and wireworms (Elaterids) attacking the larvae, and Syrphids and *Coccinella septempunctata*, L., destroying the eggs and young larvae. Woodpeckers and a shrew occasionally feed on the larvae.

Practical measures against *P. nubilalis* include the use of a special spade that removes the whole of the stubble, and a modification of the usual compost method, the maize stalk piles being covered with the remains of harvested potato or bean plants ; the larvae in this case leave the maize stalks and enter the potatoes or beans, which can be burnt in the spring.

HASE (A.). **Observations on the Corn Borer in Spain.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 143–147, 1 fig., 1 ref. Chicago, Ill., 1928.

Details are given of observations on *Pyrausta nubilalis*, Hb., in various parts of Spain in 1927. The general practice in Spain is to cut off the tassels of the maize early in the summer and to use them as fodder. The stalks are disposed of in various ways ; in some places cattle are driven into the fields to feed on them ; in other places they are pulled out or cut off 4 to 5 inches above the ground and are used for fodder or sometimes for mending roads or roofs. In some fields the stalks are ploughed under or burnt. In each of the seven localities examined, *P. nubilalis* was found to a greater or less degree, except in the neighbourhood of Madrid, where, however, little maize is grown. Larvae of *Sesamia vuteria*, Stoll (*nonagrioides*, Lef.) were frequently found in association with those of *P. nubilalis*. The only parasites noticed were Tachinids. Both species of borers were parasitised by *Lydella senilis*, Mg., the pupae of which were found in numbers in the tunnels.

KROGH (A.). **Experiments concerning the Biology of *Pyrausta nubilalis* Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 148–152. Chicago, Ill., 1928.

An account is given of experiments made in Denmark on the metabolism of strains of larvae of *Pyrausta nubilalis*, Hb., from Germany, Hungary and Italy, as indicated by oxygen consumption and weight. Under the conditions of the experiments the larvae were not able to acquire a sufficient reserve of fat to provide material for metabolism during the resting period and final development, and the experiments seem to indicate that the climate of Denmark will not normally permit of the complete development of *P. nubilalis*.

WEIS (F.), BLOM (J.) & NIELSEN (N.). **The Ability of Corn Plants to absorb and endure different poisonous Compounds. A Contribution to a therapeutic Treatment.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 153–173, 11 figs. Chicago, Ill., 1928.

Experiments have been made to determine whether it would be possible to counteract attacks of *Pyrausta nubilalis*, Hb., by means of therapeutic treatment of the maize plants, the method of absorption chosen being by the root system. The plants were cultivated in nutrient

solutions, the poisonous compounds being dissolved in the solution when the plants had reached a suitable size. The experiments, which are described, indicate that inorganic compounds do not promise any practical results. Among organic compounds, pyridine, nicotine, caffeine and resorcine may prove useful because they are more or less toxic to animals and harmless to plants. Further investigations are necessary before any definite conclusions on the subject can be reached.

KOTLÁN (A.). **A double parasitic Infection of a Larva of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 174–178, 4 figs. Chicago, Ill., 1928.

Very little is known concerning the microparasitic fauna of *Pyrausta nubilalis*, Hb., though a number of protozoa have been described as parasites of the larvae. Among larvae of *P. nubilalis* collected from Hungary in 1927, one was found showing protozoan infection and was simultaneously heavily infested with Ichneumonid larvae of almost microscopic size. The bodies found lying in groups inside the muscles and, in slightly different shapes and sizes in other organs, evidently belong to the same micro-organism, representing different stages of development. They appear to be closely related to *Nosema*, both in location and in morphological features, and the name *Nosema pyraustae* is therefore proposed for them.

DUDICH (E.). **Insect Parasites of the Corn Borer** (*Pyrausta nubilalis* **Hb.) in Hungary.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 184–190, 10 refs. Chicago, Ill., 1928.

Biological data are given on the parasites of *Pyrausta nubilalis*, Hb., in Hungary that have been recorded in previous papers of this series. Most of the pupae of *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., were found during the winter months, the first in November 1927 ; the first adult emerged in March 1928 and the last in May. Most of the adults emerge during April ; none lived in captivity for more than 28 days. The earliest emergences occur when there are no larvae of *P. nubilalis* available, so that there may be a generation living on another host ; on the other hand, individuals emerging in spring may live until summer. *Microbracon brevicornis*, Wesm., was found in several northern as well as southern localities of the trans-Danube region, and in early August eggs were observed on larvae of *P. nubilalis*. All adults emerged before 15th November, and apparently the last generation hibernates in the adult stage. Pupae of *Eulophus viridulus*, Thoms., were observed in maize stalks beside the remains of larvae of *P. nubilalis* ; adults emerged from these in April. Pupae of *Lydella senilis*, Mg., were found in the same circumstances in November and again in March, the latter producing adults in mid-April. Apparently some larvae pupate in autumn and hibernate as pupae, whereas others pupate during the spring. There is probably a spring generation that lives on a different host.

Neither *Trichogramma evanescens*, Westw., nor *Angitia* (*Inareolata*) *punctoria*, Rom., was observed by the author, though both have been recorded from Hungary by other investigators.

Husz (B.). *Bacillus thuringiensis* **Berl., a Bacterium pathogenic to Corn Borer Larvae. A preliminary Report.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 191–193, 1 ref. Chicago, Ill., 1928.

Owing to the close relationship between *Pyrausta nubilalis*, Hb. and *Ephestia kühniella*, Zell., attempts have been made to infect the corn borer larvae with *Bacillus thuringiensis*, which is virulent to *Ephestia*. Under experimental conditions it was found possible to kill the larvae of *P. nubilalis* within 1½ days by infection with the bacillus or its spores. Infection was produced by feeding the larvae on pieces of maize stalk moistened with a diluted culture of the bacillus, and also by placing spores on any surface with which the larvae came into contact. It is therefore thought possible to develop practical methods for applying *B. thuringiensis* in the campaign against *P. nubilalis*.

Knechtel (W. K.) & Ionescu (M.). **Observations on the Corn Borer in Roumania.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 194–200, 4 figs. Chicago, Ill., 1928.

Although maize is the principal agricultural crop in Rumania and *Pyrausta nubilalis*, Hb., occurs in all maize-growing sections, infestation by the moth has always been limited to almost negligible proportions, largely owing to the utilisation of maize stalks as food for cattle or as fuel. The degree of infestation varies from 1 to 40 per cent., according to the locality, with an average of about 10 per cent., but the stalks are never sufficiently excavated to cause breakage, and damage to the ears is rare. Four parasites have been observed [*R.A.E.*, A, xvii, 219] of which *Microbracon brevicornis*, Wesm., is the most important, each infested host larva harbouring from 10 to 30 parasite larvae. This parasite is well distributed throughout the steppe border lands of Rumania.

Hergula (B.). **Observations on the Corn Borer in Jugoslavia.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 201–222, 11 figs., 1 map. Chicago, Ill., 1928.

In a foreword, V. Vouk explains that as no study has previously been made of *Pyrausta nubilalis*, Hb., in Jugoslavia, the present report can be regarded only as preliminary, and rather as a collection of fundamental data to be used as a basis on which the various problems of control may be dealt with.

The distribution of *P. nubilalis* is discussed. Maize is grown throughout the country, and a map shows that the intensity of infestation coincides with that of maize growing. The heaviest infestation observed was 100 per cent., with an average of 4 or 5 borers in each plant. In the north-east, where maize is extensively grown, the average infestation was about 54 per cent., though infestation varies considerably within a given district. There is only one generation in a year, with sometimes a partial second, involving some 3 per cent. or less of the borers. Hibernation mainly occurs in the basal internodes of the maize, but under unfavourable conditions, the larvae leave the stalks and seek better shelter. The time of pupation varies with the locality ;

it is experimentally shown that a certain degree of humidity is required for pupation after hibernation ; lack of moisture retards metamorphosis and causes high mortality. Eleven food-plants other than maize are recorded. The parasites, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., *Microbracon brevicornis*, Wesm., and *Lydella senilis*, Mg., were observed, but the degree of parasitism is very low. The ants, *Myrmica laevinodis*, Nylander, and *Lasius emarginatus*, Oliv., are active predators, and tits attack infested maize stalks. The burning of waste maize stalks is considered to be the most practical way of destroying the hibernating borers, and farmers are compelled by law to carry this out.

Ellinger (T.). **Report on preliminary Corn Borer Investigations in the Union of Socialistic Soviet Republics.**—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 223–237, 6 figs., 1 map, 1 ref. Chicago, Ill., 1928.

A survey of the maize-growing regions of Russia has shown that there are two distinct maize belts, namely, in the Ukraine and in the North Caucasus and Transcaucasia ; a map illustrates the intensity of maize production in these regions. The distribution of *Pyrausta nubilalis*, Hb., as known up to the year 1924, is summarised in a table, and another table gives the maize production of the various districts. In the present survey, the degree of infestation was found to vary from 0 to 15 per cent. according to the locality, details being given of many districts examined. There is one generation of *P. nubilalis* a year in the Ukraine and two in the Caucasus and the Crimea. Data have been collected on the temperature and precipitation conditions in the localities where the studies were made, and are illustrated by charts.

The three most important parasites of *P. nubilalis* known in central Europe, namely, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., *Microbracon brevicornis*, Wesm., and *Lydella senilis*, Mg., have all been recorded in considerable numbers in the Russian maize belts, and several other species are being studied. In one region of the Ukraine where the moth had appeared in the previous year in destructive numbers, none was found in 1928, all having perished from an epidemic ; this is the most remarkable case known of the action of pathogenic micro-organisms on the corn borer.

Marston (A. R.) & Dibble (C. B.). **Corn-borer prefers Corn to Common Mugwort.**—*Quart. Bull. Michigan Agric. Expt Sta.*, xi, no. 2, pp. 69–72, 2 figs., 1 ref. East Lansing, Mich., November 1928.

Experiments carried out in Michigan to determine whether the theory developed by Roubaud [*R.A.E.*, A, xvi, 52 ; xvii, 210] could be applied to conditions prevailing there, indicated that although larvae of *Pyrausta nubilalis*, Hb. (European corn borer) from eggs laid on maize may migrate to mugwort (*Artemisia vulgaris*), maize is the preferred food-plant of the borer and that it is in no way protected from attack by the presence of mugwort. In the field 50 eggs and 23 larvae were found on 80 maize plants, and no eggs and only 3 larvae on 37 plants of mugwort. In cages containing both plants, no eggs were laid on mugwort, though the larvae sometimes attacked it.

NEEDHAM (J. G.). **Elementary Lessons on Insects.**—Demy 8vo, viii+210 pp., 72 figs. Springfield, Ill., Charles C. Thomas; London, Baillière, Tindall & Cox, 1928. Price 9*s.* net.

This textbook, intended for use in schools in the United States, presents an outline for a practical course in elementary entomology, and offers a basis of instruction in the structure, development and habits of insects, with notes on control measures and on the making and maintaining of an insect collection.

HASEMAN (L.). **Controlling the Insect Pests of Strawberries.**—*Circ. Missouri Agric. Expt. Sta.*, no. 168, 12 pp., 8 figs. Columbia, Mo., March 1928.

This is a general account of the most important strawberry pests in Missouri, with measures for their control, including *Tyloderma fragariae*, Riley (strawberry crown borer), *Ancylis comptana*, Fröhl. (strawberry leaf-roller), *Anthonomus signatus*, Say (strawberry weevil), *Lygus pratensis*, L., *Frankliniella* (*Euthrips*) *tritici*, Fitch, *Aphis forbesi*, Weed (strawberry root aphis), *Typophorus canellus*, F., and *Empria maculata*, Norton.

CURRAN (C. H.). **New Diptera in the American Museum of Natural History.**—*Amer. Mus. Nov.*, no. 339, 13 pp., 2 figs. New York, N.Y., January 1929.

The new species described include the Tachinid, *Erycia deckeri*, sp. n., a parasite of *Papaipema nitela*, Gn. (*nebris*, Gn.) in Iowa.

MARLATT (C. L.). **Report [1927-28] of the Federal Horticultural Board.**—42 pp. Washington, D.C., U.S. Dept. Agric., 1928.

The work of the United States Department of Agriculture in connection with plant quarantine and related regulatory and control activities previously dealt with by the Federal Horticultural Board in co-operation with the Bureaux of Entomology and Plant Industry has, since 1st July 1928, been carried out by a new organisation known as the Plant Quarantine and Control Administration, the head of which is *ex officio* chairman of an advisory Federal Plant Quarantine Board. The purpose of the reorganisation is to secure better administration by bringing together into one unit all activities dealing with the regulation and control of movement of plants and plant products on account of insect pests and plant diseases, and to leave the Bureaux of Entomology and Plant Industry free to carry out research work.

The work of the Federal Horticultural Board for the year 1927-28 is reviewed, and a summary is given of the quarantines promulgated or revised during the year.

The pests intercepted included: The West Indian fruit-fly [*Anastrepha fraterculus*, Wied.], in grapes from Peru and in mangoes from Cuba, Haiti and Jamaica; the Mexican fruit worm [*A. ludens*, Lw.], in a variety of fruits from Mexico; the melon fly [*Dacus cucurbitae*, Coq.], in cucumbers and green beans from Hawaii; the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], in a variety of fruits from Algeria, the Azores, Hawaii, Italy, Madeira, Sicily and Spain; the olive fruit-fly

[*Dacus oleae*, Gmel.], in olives from Italy ; the cherry fruit-fly [*Rhagoletis cerasi*, L.], in cherries from France ; *Cydia* (*Laspeyresia*) *splendana*, Hb., in chestnuts from France and Italy ; *Curculio* (*Balaninus*) spp., in chestnuts from China, France, Italy, Japan, Spain and Switzerland, in acorns from France and Turkey, in filberts from Italy and Spain, and in walnuts from Italy ; the pink bollworm [*Platyedra gossypiella*, Saund.], in cotton-seed from Santo Domingo, Egypt, Syria and India, and in cotton bolls and raw cotton from Hawaii ; *Chilo simplex*, Butl., in rice straw from Japan ; *Chilo* sp., in sugar-cane from Mexico ; *Euscepes batatae*, Waterh., in sweet potatoes from Brazil, Cuba and Porto Rico ; the turnip gall weevil [*Ceuthorrhynchus pleurostigma*, Marsh.], in turnips from England, Belgium, Holland, Denmark and France ; *Conotrachelus aguacatae*, Barber, and *Heilipus* sp. (avocado weevils), in avocados from Mexico and the Panama Canal Zone respectively ; and various Lepidoptera on fruit stocks from France.

The situation with regard to *P. gossypiella* is reviewed. At the beginning of 1928 this moth was found in seven new counties in western Texas [*R.A.E.*, A, xvi, 463]. The extent of the infestation was determined, and control measures were immediately carried out. It had been hoped to eradicate the pest by the enforcement of non-cotton zones over this area during 1928, but the appropriation of Congress for the compensation of losses to farmers in non-cotton zones was only available for areas where live bollworms were found. Unfortunately, owing evidently to the severity of the weather, only dead bollworms were found in this case, although undiscovered bollworms may quite possibly have survived in seed carried away from the field to storage bins, gins, or mills, or in the soil about the base of the plants where they are fairly well protected by a covering of 2–3 inches of soil. Unless eradication can be effected, *P. gossypiella* will spread eastwards through the continuous cotton belt of Texas and the hope of eliminating it will then have disappeared. In the areas in central and eastern Texas and in Louisiana in which *P. gossypiella* seems to have been eradicated, intensive investigations in connection with the 1927 crop revealed no sign of infestation. Infestation was found in an isolated field in the Santa Cruz valley of Arizona, a point further west than has yet been reached by the pest.

Several new infestations of date scale [*Parlatoria blanchardi*, Targ.] were discovered during the latter part of 1927 in California and Arizona, and a general survey of all date plantings in California, Arizona and Texas was subsequently carried out to determine the extent of the existing infested areas. The results so far indicate that there is a possibility of ultimately eradicating the scale. Preliminary measures were carried out in connection with the survey, and infested trees were defoliated and burned over with torches, or, in the case of abandoned plantings, dug up and destroyed.

The measures taken against *Anastrepha ludens* [*R.A.E.*, A, xvi, 271, 505] have been most successful, and the large *Citrus* crop of 1927–28 has been harvested without the discovery of a single infested fruit. These results seem to indicate the possibility of protecting *Citrus* indefinitely by a continuation of the measures now in force The drastic programme of eradication involving the enforcement of the starvation period each season from 1st March to 30th September, as well as the repeated inspection of *Citrus* groves and control of movement of fruit, must be carried out as long as infested fruit continues to be brought to neighbouring Mexican markets or as long as there is any infestation on the

Mexican side of the border. The object of this non-fruit period is to prevent any adult fruit-flies that may cross the border, or that may emerge from infested fruit illegally imported from Mexico, from finding any fruit suitable for breeding purposes.

SPULER (A.). **Summer Oil Sprays for the Control of the Codling Moth.**— *Proc. Washington State Hort. Ass.*, xxiii (1927), pp. 39–44. Olympia, Wash. [1928.]

Experiments have been conducted against the codling moth [*Cydia pomonella*, L.] at Wenatchee with lubricating and drying oils to determine the value of the latter as an adhesive for arsenical sprays, the value of lubricating oil as a combined adhesive and ovicide, and the possibility of substituting lubricating oils for lead arsenate. As lubricating oils may contain as much as 50 per cent. sulphonatable material, which is very toxic to growing plants, only the water-white, highly refined oils can be used as foliage sprays.

Experiments were made with a drying oil (fish oil) used at 0·25 per cent. strength combined with lead arsenate, by pouring the oil into a tank of spray mixture that was being stirred. The oil was readily taken up by the spray, and the mixture covered the fruit without forming the distinct blotches common when lead arsenate is used alone. Five applications were made on two varieties of apple, and in each case infestation was less than when lead arsenate alone was used. Fish oil was also combined with a form of calcium arsenate and with magnesium arsenate, but although the combinations gave better results than the arsenicals used alone, they were not so good as those obtained with lead arsenate. Foliage injury by the calcium arsenate was more severe when fish oil was used. It is thought that fish oil is of value only as an adhesive, as the small amount used would be unlikely to have any ovicidal effect.

The combination of lead arsenate and lubricating oil gave very good results, the oil improving the wearing properties of the lead arsenate and acting as an ovicide; experiments were made with three types of white lubricating oils and Volck, used at 1 and 1½ per cent. strength respectively. Five applications were made during 1926, and on trees sprayed with lead arsenate alone 7·9 per cent. of the apples were infested, and on those sprayed with a combination of lead arsenate and Volck, only 1·8 per cent. In 1927, only three applications were made with a combination of one of the lubricating oils and lead arsenate and five were made with lead arsenate alone. The number of hibernating larvae from the previous year was not great, so that the difference between the results given by the two sprays was not large, but the percentage of infested fruit was 0·27 with the first spray and 1·18 with the second. The combination is of special value where the number of moths is very large, since it will reduce the number of "stings."

Lubricating oils are non-volatile under orchard conditions, but are only effective as an ovicide for a few days after application; applications must therefore be repeated at intervals of 10–14 days. Approximately 85 per cent. of the eggs sprayed with 1 per cent. oil were killed. A table is given showing the results obtained by the use of 5 applications of oil and no lead arsenate sprays, of three oil sprays used against the first generation and two lead arsenate sprays against the second, and of one lead arsenate spray followed by two oil sprays for the first generation

and two lead arsenate sprays for the second ; these indicate that as many as three lead arsenate sprays may be eliminated by using oil sprays. These may, however, complicate the problem of spray residue removal ; a larger percentage of spray residue remained on the fruit after washing, when it had been sprayed with a combination of oil and lead arsenate, than when lead arsenate alone was used. Moreover, oil sprays, even when refined to the point where they consist almost entirely of saturated hydrocarbons, have still been found to have a physiological effect on the trees, retarding the growth of the fruit and reducing its size. It is possible that small applications may be used without materially injuring the trees or the fruit, but the author considers that at the present time oil sprays for summer use should be regarded as being in the experimental stage.

REGAN (W. S.). **Oil Sprays and their Relation to Orchard Pest Control** —*Proc. Washington State Hort. Ass.*, xxiii (1927), pp. 64–71. Olympia, Wash. [1928.]

Various problems relating to the use of oil sprays against orchard pests are discussed, much of the information having been previously noticed [*R.A.E.*, A, xvi, 514]. The dangers of the use of inferior oil sprays are emphasised, and it is stated that a good grade dormant oil spray should, if possible, be at least 60 per cent. refined and of a fairly high viscosity. The author considers that reactions to oil sprays become evident within a few weeks or months, and that there is very little danger of cumulative oil injury ; there is at least one orchard in the eastern United States that has received annual applications of dormant oil spray for 15 successive years, without any resulting damage, and the use of oil sprays is on the increase in California and has been a routine practice in Florida for some time. Oil sprays have in larger potential range of effectiveness than any other known insecticide and exert some degree of control on almost all the common orchard pests.

A dormant oil spray with from $2\frac{1}{2}$ to $3\frac{1}{2}$ per cent. actual oil content is an effective control for the San José Scale [*Aspidiotus perniciosus*, Comst.] and is cheaper and more agreeable to use than lime-sulphur. Applications of $1\frac{1}{2}$–$2\frac{1}{2}$ per cent. commercial summer oil may also be made at any time in the summer in cases of emergency, the best time being about the first half of June, just before the larvae migrate to the fruit. Heavy applications of oil spray should never be made to maturing fruit. Delayed dormant oil sprays are also an effective control for green aphis [*Aphis pomi*, DeG.] and rosy aphis [*Anuraphis roseus*, Baker] on apple and the common Aphids of cherry, peach and prunes. The best time for application is just as the blossom buds are bursting, or on peach shortly before they burst ; a spray containing $1\frac{1}{2}$–2 per cent. actual oil is sufficient for an effective kill where Aphid control is the main consideration. Although summer oil is of some value in the control of Aphids, satisfactory results are difficult to obtain because of the protected position of the insects in the curled leaves. In such cases the best results can be obtained by the use of nicotine or a nicotine-oil spray combination ; the latter is also of value in the control of the woolly aphis [*Eriosoma lanigerum*, Hausm.]. Summer oils, or dormant oils in cases where the eggs overwinter on the trees, are also recommended for the control of various mites. Although dormant lime-sulphur is on the whole a more effective control for blister mite

[*Eriophyes*], good results can be obtained with oil sprays if these are properly applied. Applications should thoroughly drench the terminal twigs and smaller branches, as the mites hibernate under the bud scales, and should be made when the scales are separating and be completed before the buds show more than the green tips. It is thought that summer oil may also be effective against blister mite, especially if applications are made just before or during the midsummer migration period.

GILMER (P. M.). **Results of Government Tests for the Control of the Codling Moth in Kansas.**—*Bienn. Rep. Kans. State Hort. Soc. 1926–1927*, xxxix, pp. 11–15. Topeka, Kans., 1928.

An account is given of two seasons' work on the control of the codling moth [*Cydia pomonella*, L.] in the Arkansas and Missouri valleys in Kansas. The infestation during 1926 was extremely severe, and none of the measures gave satisfactory control. Sprays of 1 lb. lead arsenate to 50 U.S. gals. water were quite inadequate, but the more satisfactory results obtained with the heavier dosages led to the recommendation of not less than 2 lb. to 50 U.S. gals. At the same time 3 lb. was suggested for the calyx spray and the second and third cover sprays. Climatic conditions during 1927 were much more favourable for control, the cool weather, heavy rains and especially cool nights causing a heavy natural mortality of the first brood. The numbers of the second brood were thus reduced, and the late season practically destroyed the whole of the third brood, except in a few localities. These infestations, however, showed clearly that even in years favourable for control, the third brood cannot be neglected.

The time of application of the first cover spray was determined by observation of temperature at sunset. Spraying should be completed on the fifth or sixth day after this temperature has risen above 65° F., since under ordinary circumstances seven days elapse before hatching begins. Later in the season this period is considerably shortened. The second spray is similarly timed, but since oviposition sometimes takes place at temperatures as low as 60° F., spraying should not be delayed too long in case of a long period between favourable nights, and its application between the 6th and 12th day after the first spray is recommended. The third cover spray should be applied after 10–12 days, depending upon the growth of the apples and on the rainfall that might wash off the previous spray. If the emergence of the last over-wintering individuals is much delayed, a fourth spray may be necessary for the first brood. A spray for the second brood should be applied about 15–20 days after the third cover spray for the first, but this also may vary with the year. Ordinarily two sprays are sufficient for the second brood, the second being applied 10–12 days after the first. If sprays have to be applied in August, they should be applied as early as possible to avoid the problem of residue, but in the Arkansas Valley section they should be applied after 5th August to be effective. The dosage should not be greater than 1½ lb. to 50 U.S. gals. because of the residue, and such sprayed apples may need wiping before marketing. Several other spray materials were tested, but none of them was found practical for use under commercial conditions. Oil was used as a supplement to the lead arsenate spray, and although results so far as infestation was concerned were almost the same as where arsenate was used alone, the percentage of "stings" was considerably reduced. The heavy cost of the oil and the difficulty of

removing the gummy deposit from the fruit make its commercial use undesirable, except possibly in the second and third cover sprays, in which case it is necessary to add a spreader and about 1 qt. of the oil to 100 gals. of the subsequent lead arsenate spray to obtain proper adherence. It is believed that other sprays applied afterwards will adhere without difficulty. Oil used alone was only satisfactory in light infestations.

A number of chemically treated bands showed good results, the most effective being those treated with cylinder oil, and cylinder oil and beta naphthol. The latter gave a mortality of about 80 per cent. and did not require renewing during the season. Cylinder oil was equally efficient during the first few weeks, but the seasonal mortality was only about 68 per cent. It is estimated that the beta naphthol will give results closely approximating those obtained from untreated bands under ordinary conditions of commercial practice. If this estimate is correct, the objection that the cost of renewing bands every ten days is prohibitive will be removed. A number of materials were used for the bands, the best being three folds of burlap. Chemically treated crêpe paper bands were effective in certain sections, and further tests will be made with the corrugations cut parallel to the length of the band, since, if it is possible to avoid sagging, this material will be cheaper and more effective than burlap.

The bands are easily made, the mixture either being painted on, after mixing the beta naphthol with the oil to get the consistency of thick paint, or the burlap may be cut to size in long rolls, run through a tub containing a few gallons of the mixture so as to become thoroughly soaked, and then through an ordinary wringer to remove excess. It may then be rolled and cut off as the bands are applied.

KELLY (E. G.). **Study on Arsenical Tolerance of Insects.**—*Bienn. Rep. Kans. State Hort. Soc. 1926–1927*, xxxix, pp. 18–21. Topeka, Kans., 1928.

The arsenical compounds used as insecticides and the literature dealing with their toxicity are briefly reviewed. The author points out that there are various gaps in our knowledge that will have to be filled before it will be possible to determine the tolerance of insects to arsenicals of various kinds.

HUNGERFORD (H. B.). **Quarantines and the Work of the Kansas Entomological Commission.**—*Bienn. Rep. Kans. State Hort. Soc. 1926–1927*, xxxix, pp. 21–25. Topeka, Kans., 1928.

The author shows how man has upset the balance of nature, giving instances of indigenous insects that have become pests of economic crops and of introduced insects that have become established in the United States, and suggests that had rigid quarantine and inspection been enforced the entrance and spread of these pests might have been prevented. There are few State quarantines in Kansas because most of the needs are covered by Federal quarantines. The work of the Kansas Entomological Commission in removing hedges of Osage orange [*Maclura aurantiaca*] infested with San José scale [*Aspidiotus perniciosus*, Comst.] that are a menace to neighbouring orchard and nursery plantations is discussed.

Hungerford (H. B.). **The Entomological Commission and its Protection for the Horticulturist.**—*Bienn. Rep. Kans. State Hort. Soc. 1926–1927*, xxxix, pp. 25–31. Topeka, Kans., 1928.

The purpose of the Entomological Commission is to protect the agriculture and horticulture of Kansas against the admission of new pests and to reduce the economic losses due to insects. An account is given of the life-history of the oriental peach moth [*Cydia molesta*, Busck], which may at any time make its appearance in Kansas. The inspection of all nursery stock intended for movement within or into the State in order to prevent the spread of insect and fungous pests is discussed. Popular notes are given on some of the insect pests occurring in Kansas.

Dean (G. A.). **Some Mites infesting Fruit Trees.**—*Bienn. Rep. Kans. State Hort. Soc. 1926–1927*, xxxix, pp. 31–35. Topeka, Kans., 1928.

An account is given of the bionomics and control of *Bryobia praetiosa*, Koch (*pratensis*, Garm.), *Tetranychus telarius*, L., and *Paratetranychus pilosus*, C. & F., which has not yet been recorded from Kansas. A summary showing the distinguishing characters of the eggs, nymphs and adults and the differences in habits of these mites is appended.

Bryson (H. R.). **A Method for rearing Wireworms (Elateridae).**—*J. Kans. Ent. Soc.*, ii, no. 1, pp. 15–21, 5 refs. McPherson, Kans., January 1929.

After reviewing the methods hitherto in use for rearing Elaterids, the author describes a system employed for the first time in 1928 with much better results. Cages consisting of two ordinary unglazed drain tiles 6 inches in diameter and 1 foot in length were sunk in the earth with a flat rock as the base of the lower tile; they were then filled in with soil, in which wheat and oats were planted. A screen wire cone, 6 inches high, was placed above, and 25 larvae were placed in each cage. It was possible to account for 44 per cent. of the 525 larvae collected and placed in the cages, 38·9 per cent. of which emerged as adults. About 92 per cent. of the 199 beetles taken (90 per cent. of which were taken from their pupal cells) were below the 6-inch plough line, with an average depth of slightly more than 9 inches.

Smith (R. H.). **Recent Developments in our Knowledge of the Codling Moth and its Control.**—*Blue Anchor*, v, no. 12, pp. 18, 70–71, 1 fig. Sacramento, Cal., California Fruit Exch., December 1928.

In discussing the history of control measures for the codling moth [*Cydia pomonella*, L.], the author states that lead arsenate sprays on apple are not considered as effective as they used to be [*R.A.E.*, A, xvi, 675, etc.]. Supplementary control measures are therefore recommended. Experiments have shown that about half the larvae maturing in the fruit on the trees can be trapped by banding, and that bands excluding the most light are generally the most effective. The average number of larvae caught under different bands, all of which were 5 ins. wide, was as follows: 10 oz. burlap, one thickness, 15, two thicknesses (folded once), 87, three thicknesses (folded twice), 186; 10 lb. tarred felt building paper, one thickness, 178. Bands should be placed on the

trees about 15th June in California, and the larvae destroyed every 10 days, or at least every fortnight, throughout the summer. Baiting with a mixture of 1 part vinegar to 10 parts water placed in wide-mouthed jars at the tops of the trees is of some value, particularly against the moths that give rise to the first brood, and for determining the time when the first cover spray should be applied.

PARKER (W. B.). **The Bud Form of the Pear Leaf Blister Mite.**—*Blue Anchor*, v, no. 12, pp. 20–21, 73, 3 figs. Sacramento, Cal., California Fruit Exch., December 1928.

Treatment with lime-sulphur in the autumn, which is an efficient control for the ordinary form of the pear-leaf blister-mite (*Eriophyes pyri*, Pgst.) in California, is useless against a strain that attacks the buds. A description of the injury done by the latter is given; the mite kills the buds during the winter and early spring and deforms the blossoms and young fruit, causing them to drop, and in severe cases dwarfs the foliage; such fruit as is produced from the injured buds is small and russeted. Trees that have been free from leaf blisters for several years are frequently severely infested by the bud mite. The mites are found under the first fruit-bud scales in late summer and remain there, gradually increasing in numbers until the spring, when they are frequently so numerous as to have completely destroyed the buds. Eggs are present until the middle of June, oviposition beginning again in September and continuing until the spring. In this respect the bud strain differs from the ordinary form of the blister-mite, which hibernates in the buds without depositing eggs there. When the new growth starts in the spring, the mites leave the dead and opening cluster buds and attack the tender shoots; they are first found inside the new leaves, but later penetrate into the axils, migrating up the twig as the leaves open. As many as 80 mites have been found in the axil of one leaf. Lime-sulphur, nicotine and soap or spreader, or foliage oils are capable of killing all the mites when they can be reached with the spray, but they are so well protected by the foliage that the time of application is of more importance than the material used.

GAMMON (C.). **Report on the Black Walnut Fly.**—*Mon. Bull. California Dept. Agric.*, xvii, no. 11, pp. 603–605, 2 figs. Sacramento, Cal., November 1928.

Rhagoletis juglandis, Cress. (black walnut fly) has been found scattered over an area of 23 square miles in south-western California. Practically every variety of walnut grown in this district is attacked. The adults emerged between 25th July and 10th September, the maximum emergence occurring from the beginning of the second week in August to the first week in September. Oviposition took place a little more than two weeks after emergence, 15–25 eggs being laid in the green husk of the walnut. The eggs hatch in 3–4 days. The migration of the young larvae in all directions from the oviposition puncture is closely followed by decay; the nuts turn black, and the larvae are found about the periphery of the decayed mass. After about 16 days, the larvae drop to the ground, burrow into the soil to an average depth of 8 inches, and pupate within two days. In a few isolated cases larvae pupated within the husk. There is some evidence that the pupal stage may be

prolonged to produce at least a partial two-year life-cycle. The injury does not affect the kernel unless the nut is attacked very early, when the attendant decay may penetrate the shell. It does, however, affect the market value by producing an unsightly stain that cannot be removed by any bleaching agent, and, in addition, the handling of infested nuts is very disagreeable, as the husk is a slimy, black, decayed mass, with a rather offensive odour.

The natural hardiness of the pupae and the depth at which they lie prevent any effective measure being taken against them. The larvae are inaccessible and emerge too long before harvest to allow of any remedial measures at that time, except possibly the removal of the husks of infested nuts over some receptacle to catch the few remaining larvae. It therefore seems advisable to direct control measures against the adults during the two weeks before oviposition, and in one orchard where a spray of 4 lb. basic lead arsenate to 100 U.S. gals. water was employed, it was estimated that the infestation was reduced by about 70 per cent.

Smith (E. L.). **Regulation of Narcissus Bulb Pests in California.**— *Mon. Bull. California Dept. Agric.*, xvii, no. 11, pp. 614–619, 3 figs. Sacramento, Cal., November 1928.

The history of the control of *Narcissus* bulb pests in the United States, with particular reference to California, is reviewed, and the value of quarantine regulations is pointed out. The distribution of vats for hot water treatment is discussed, and various types of fumigation chambers for use with calcium cyanide against *Merodon equestris*, F., and *Eumerus* spp. are very briefly described [*cf. R.A.E.*, A, xvii, 163].

Fulton (B. B.) & Brunson (M. H.). **Strawberry Leaf-roller Control.**— *Circ. Iowa Agric. Expt. Sta.*, no. 110, 8 pp., 3 figs. Ames, Iowa, March 1928.

In this popular account of the measures in use against the strawberry leaf-roller [*Ancylis comptana*, Fröhl.] in Iowa, the application of a spray consisting of 3 lb. lead arsenate and 50 U.S. gals. Bordeaux mixture (4–4–50), with or without the addition of 1 U.S. pt. linseed oil, to both upper and lower surfaces of the leaves is recommended. Spraying should be carried out both before and after blossoming, but never during full bloom or when the berries are half-grown or larger. Second brood larvae may be destroyed by two applications about 8–10 days apart made shortly after the crop is removed, or by mowing and burning the foliage, and two or more sprays are necessary to check the third brood, which begins to appear late in July or early in August.

Cook (W. C.). **Weather and Probability of Outbreaks of the Pale Western Cutworm in Montana and near-by States.**— *U.S. Mo. Weather Rev.*, lvi, no. 3, pp. 103–106, 1 fig. Washington, D.C., 1928. (Abstract in *Expt. Sta. Rec.*, lix, no. 8, p. 760. Washington, D.C., December 1928.)

A rather close connection has been found between the chances of a single favourable year and the ability of the pale western cutworm [*Porosagrotis orthogonia*, Morr.] to maintain itself in a locality. At least one year in ten must be favourable to the increase of the moth,

or it will disappear. Outbreaks brought on by migrating moths are confined to regions where at least one year in 20 is favourable. Severe damage by this cutworm may be expected only at long intervals throughout the greater part of its range. In the dry mountain foothills near Helena (Montana) such outbreaks will be about 16 years apart, on the central plains of Montana and in Wyoming they may occur once in 20–25 years, and in eastern Montana and Colorado the average interval between outbreaks is about 30 years. In other parts of the United States the moth will probably be injurious still more rarely. Slight outbreaks may be expected somewhat more frequently.

SPENCER (G. J.). **Dead** *Pollenia rudis* (**Fabr.**) **as Hosts of Dermestids.**—*Canad. Ent.*, lx, no. 12, p. 283. Orillia, Ont., December 1928.

Investigations to determine the breeding-place of the Dermestids, *Anthrenus museorum*, L., and *A. scrophulariae*, L., which infested dwelling houses in Toronto in the spring of 1928, resulted in the discovery in an unused attic of a number of dead cluster flies (*Pollenia rudis*, F.) infested with the larvae of *A. museorum* in all stages of development, together with pupae and adults about to emerge. The breeding-place of *A. scrophulariae*, of which no trace was found among the flies, was not discovered. As *P. rudis* was unusually abundant in Toronto in 1928, the masses of this fly occurring in attics should be sprayed, and the dead insects collected and burnt to prevent them from becoming breeding-places of the beetles.

HOPPING (G. R.). **The Western Cedar Borer** (*Trachykele blondeli* **Mars.**).—*Pamph. Dept. Agric. Canada*, N.S., no. 94, 17 pp., 10 pls., 1 map. Ottawa, July 1928.

Much waste of telegraph poles and serious loss to the pole industry in parts of British Columbia have been caused through the discarding of poles of western red cedar [*Thuja plicata*] infested by *Trachykele blondeli*, Mars. (western cedar borer). An account is given of a detailed investigation of this problem carried on since 1925. This indicates that much of this loss is unnecessary, and that, in general, poles are not materially weakened by the work of the borer. Data of the life-history of *T. blondeli* vary only slightly from those previously noticed [*R.A.E.*, A, xvi, 94]. The larval stage is stated to last at least two years. Evidence hitherto obtained indicates that the eggs are not laid on the trunk below the crown, and never on any material other than living trees. Poles will therefore not become infested after peeling, nor will the borer spread from pole to pole. The average length of the galleries is less than 20 ft., and in several cases adults have been observed to develop in a section only 4 ft. long.

The distribution of this Buprestid in British Columbia, where it is generally common in the neighbourhood of tidewater, is discussed. The most favourable sites for the borers appear to be exposed from south-east to south-west, and severe infestations rarely occur on swampy sites where the trees are heavily shaded. At over 800 ft. above sea-level, the beetles become scarce and cause only negligible damage. Owing to the difficulty of detecting infested trees by inspection, there is no practical method of control under present forest conditions, but if cedar slash were burned as soon as possible after logging, it would help to prevent the spread of the borers to new areas. The results of a

preliminary test indicate that submergence of poles for a moderate period in fresh water is useless for killing the larvae. It has been conclusively shown by a series of tests that there is no material reduction in the strength of a large majority of the poles infested by the borer ; poles showing not more than 4 galleries on a single end, or not more than a combined number of 6 galleries on the two ends, are not materially weaker than sound poles and would give as good service. Evidence collected in the examination of seasoned poles subsequent to testing indicates that the majority of larvae die when the pole becomes thoroughly seasoned and that damage caused to poles after cutting is relatively small.

Swaine J. M.). **Forest Entomology and its Development in Canada** —*Pamph. Dept. Agric. Canada*, no. 97, 20 pp. Ottawa, 1928.

Much of the information given in this paper has already been noticed [*R.A.E.*, A, xiii, 192 ; xvi, 502, etc.]. *Tortrix* (*Cacoecia*) *fumiferana*, Clem., attacks the opening buds and young shoots of balsam fir [*Abies balsamea*] and spruce in the spring ; the young foliage is preferred, but when this has been destroyed, the older foliage is attacked, the trees being injured or killed outright, although the effect of an apparently equal degree of feeding varies greatly in different parts of the same stand. This is probably accounted for by the fact that the buds of balsam fir and white spruce [*Picea canadensis*] open 1–3 weeks earlier than those of the red and black spruce [*P. rubra* and *P. mariana*]. The larvae develop rapidly in the growing balsam fir shoots, most of which are killed in a heavy infestation ; the white spruce shoots, however, grow with such rapidity that in a normal attack they complete their development in spite of the feeding of the larvae. The characteristics of the attack in the different Provinces are discussed. The eggs of *T. fumiferana* are generally laid in the upper exposed part of the crown, coniferous stands under a hard-wood canopy not usually suffering seriously. A number of other pests, the attacks of which apparently follow those of *T. fumiferana*, were thought at one time to be likely to be of some importance in killing the weakened trees. *Ips* (*Pityokteines*) *sparsus*, Lec. (balsam bark-beetle), however, only attacks dying trees. *Monochamus marmorator*, Kby. (balsam sawyer) is at most of local importance, although it does attack living trees. *Dendroctonus piceaperda*, Hopk. (eastern spruce beetle) is frequently present in forests infested by *T. fumiferana*, but is seldom observed in spruce attacked by this pest, the relatively dry condition of the bark of these trees being probably unattractive to the beetles. *Pissodes dubius*, Rand. (balsam weevil) can only mature in weakened trees, although it feeds and lays eggs in healthy ones, apparently spending the first season cutting food punctures in the bark of the trees, and only laying eggs during the second year. These food punctures were surrounded by an area of resin cells, and where the feeding is very abundant, even a healthy tree may have the sap flow reduced to such a degree that resistance is completely reduced and the tree is killed.

Parasites have not as a rule proved effective in controlling outbreaks of *T. fumiferana* in eastern Canada, but in the current outbreak in Cape Breton Island they are unusually abundant, and they appear to be of some importance in infestations that have occurred in British Columbia. The exhaustion of the available food-supply has been the cause of the decline of outbreaks in most other cases. As a result

of experiments with aeroplane dusting, it has been found that a fairly satisfactory control can be obtained on balsam foliage with applications of 30 lb. poison dust to an acre, 10–15 lb. being apparently too little.

It has been observed that in some valleys *Dendroctonus piceaperda* [xiii, 189, xvi, 573] killed approximately 50 per cent. of the large spruce, after which it practically disappeared leaving the remainder of the trees uninjured. A study of the annual rings showed that more than 10 per cent. of the trees killed were growing as fast as any in the stand and a considerable percentage was making average growth ; it was therefore concluded that the attack is not entirely dependent on the age and condition of the trees. The flow of resin resulting from the cutting of egg-tunnels in a healthy tree had frequently drowned numbers of the beetles, and the heaviest flow came from trees that were growing either very rapidly or very slowly, but there seemed to be no constant relation between the rate of growth and the resin flow.

Lamiids of the genus *Monochamus*, especially *M. scutellatus*, Say, and *M. notatus*, Drury, are responsible for serious injury to windfalls and fire-scorched trees and logs of pine, spruce and balsam fir in eastern Canada. Logs that must be left in the woods throughout the summer are protected by securing them in lakes or rivers by booms, or where this is not possible by covering them with spruce or balsam boughs. Promising results were obtained in preliminary tests by covering piles of timber with boughs, earth and wire netting, or by dusting them with insecticides, such as lime-sulphur.

During the summer of 1928, severe damage was caused by *Ellopia fiscellaria*, Gn. (hemlock looper) in south-eastern Ontario, the attack being confined entirely to hemlock [*Tsuga*]. Successful control of this pest has been obtained by aeroplane dusting with 20 lb. calcium arsenate to the acre. In Newfoundland *E. fiscellaria* attacks balsam fir and to a less degree spruce. A method of control proposed as applicable under the special conditions obtaining in this region was to concentrate the cutting largely on the areas containing a high percentage of balsam until these were removed ; and to cut clean and burn the cut areas broadcast and thus to obtain reproduction containing a high percentage of spruce, the seedlings of which are usually crowded out by those of balsam, which germinate more readily in the thick covering of moss.

An account is also given of the bionomics and economic status of *Trachykele blondeli*, Mars. [see preceding paper], followed by notes on various minor pests [xvi, 191], including *Agrilus anxius*, Gory (bronze birch borer), which is the most destructive enemy of the white birch in eastern Canada, and probably also attacks all species of birch and to a less degree native poplars ; *Pissodes strobi*, Peck (white pine weevil), which is the most important pest of white pine [*Pinus strobus*] in Canada ; and Aphids of the genus *Chermes* (*Adelges*), which infest spruce shade trees, but are of little importance under forest conditions.

DE ANDRADE (E. Navarro). **Contribuição para o estudo da entomologia florestal paulista.** [A Contribution to the Study of Forest Entomology in S. Paulo.]—*Bol. Agric.*, xxix, no. 7–8, pp. 446–453. S. Paulo, July–August 1928.

This is a further annotated list of forest pests in the state of S. Paulo [*R.A.E.*, A, xvii, 159].

Bondar (G.). **Uma seria praga do repolho na Bahia,** *Plutella maculipennis* **Curtis.** [*P. maculipennis*, a serious Pest of Cabbage in Bahia.]—*Chacaras e Quintaes*, xxxviii, no. 6, p. 602, 1 fig. S. Paulo, 15th December 1928.

Plutella maculipennis, Curt., is a serious pest of cabbages in Bahia. The egg, larval and pupal stages last 3–4, 9–10, and 4 days respectively.

Morstatt (H.). **Termitenbekämpfung in den Tropen.** [Termite Control in the Tropics.]—*Tropenpflanzer*, xxxi, no. 12, pp. 475–483. Berlin, December 1928.

This is a general account of the types of damage caused by termites to structures and plants. The various methods of control are reviewed.

Dammerman (K. W.). **The Agricultural Zoology of the Malay Archipelago.**—Super Roy. 8vo, xi+473 pp., 40 pls., 179 figs., 1 map, 11 pp. refs. Amsterdam, J. H. de Bussy Ltd., 1929.

This book is to a large extent an English edition of the author's work on the agricultural zoology of the Dutch East Indies [*R.A.E.*, A, viii, 360] and is arranged on the same lines, but its scope has been very considerably increased to cover the pests of the Malay Peninsula and the Philippines, and information that has become available since the publication of the previous edition has been included. As regards the Philippines, in addition to other sources of information, the author has consulted the notes on agricultural pests collected at the College of Agriculture at Los Baños.

Weights and measures for insecticides, etc., are given according to the metric system, but a useful appendix is included, showing the British, American and native equivalents.

As regards the nomenclature of the insects and other pests dealt with, the author generally uses the names that he considers to be the best known, without attempting a revised synonymy. In addition to an alphabetical index, however, he also includes a systematic index, so that it is easy to discover the name that he is using for any given insect. An index to the plants is also given, showing the part of the plant attacked by each pest.

Though the insect pests of the areas under consideration are similar, the scattered work done on them does not appear to have previously been collated. A text-book of this character should therefore prove very useful, its value being enhanced by the fact that the remedial measures recommended are such as can be applied in places where elaborate machinery and skilled labour are not available.

Hazelhoff (E. H.). **Witteluisbestrijding en biologie der Boorderei-parasiten.** [Work against the White Woolly Aphis and Biology of the Borer Egg-parasites.]—Voordracht gehouden voor het Tiende Suikercongres te Soerabaia op 17 April 1928, 15 pp., 1 fig.

Much of the information here given has already been noticed [*R.A.E.*, A, xv, 518; xvi, 628]. *Encarsia* [*flavoscutellum*, Zehnt.], the native Chalcid parasite of the white woolly aphis [*Oregma lanigera*, Zehnt.] attacking sugar-cane in Java, increases rapidly in December and January, probably because the greater atmospheric moisture after the onset of the

rainy west monsoon is favourable to it. The entomological problems associated with sugar-cane cultivation in Java are peculiar, as owing to the system of crop rotation all cane pests and their parasites have to migrate from the old plantations to the new ones. The value of *E. flavoscutellum*, which is a weak flyer and which can be collected in quantity in the old plantations, can thus be enhanced by introduction into new ones. This would be more difficult in the case of *Phanurus* and *Trichogramma*, the egg-parasites of the sugar-cane moth-borers, which would have to be bred; moreover, in small plantations these parasites appear quite early, though in large ones they may perhaps spread less rapidly than the moth-borers. *Phanurus beneficiens*, Zehnt., oviposits in the egg of the stem-borer, *Diatraea venosata*, Wlk. (*striatalis*, Sn.), from which the adult emerges in about 10 days; as many as 80–90 per cent. of the eggs are sometimes parasitised. *Trichogramma*, a less important parasite, is so small that one egg of *D. venosata* sometimes contains 4–6 parasites. The eggs of the most important tip-borer, *Scirpophaga auriflua* var. *intacta*, Sn., are parasitised by a species of *Phanurus*, probably not *P. beneficiens*. A Coccinellid beetle, *Coelophora biplagiata*, Swartz, imported from Indo-China against *Oregma lanigera* [*R.A.E.*, A, xiv, 591], is of little importance, as it only increases slowly.

Mahdihassan (S.). **An Experimental Study of the Life Cycles of Lac Insects. Part i.**—*J. Sci. Assoc. Maharajah's Coll. Vizianagaram*, iii, no. 1–4, pp. 69–112. Madras, 1927.

The author summarises in this paper a series of 73 experiments elucidating points in the life-history of lac insects, the species dealt with being *Laccifer* (*Lakshadia*) *mysorensis*, *L.* (*L.*) *communis*, *L.* (*L.*) *nagoliensis*, *L.* (*L.*) *indica*, *L.* (*L.*) *sindica*, *L.* (*L.*) *chinensis* and *L.* (*L.*) *fici*.

Isaac (P. V.). **Report of the Imperial Entomologist.**—*Sci. Rep. Agric. Res. Inst. Pusa 1927–28*, pp. 71–78. Calcutta, 1928.

Pests of sugar-cane included termites, which killed 12·5 per cent. of the young plants in experimental plots within 60 days of planting. Numbers of the termites were destroyed by firing dry grass that had been previously placed in trenches to attract them, and the plots were irrigated with water charged with crude-oil emulsion, which prevented further damage to the plants. Numerous reports were received of deadhearts caused by *Scirpophaga nivella*, F., the eggs of which are laid under field conditions during the middle of March and again at the end of June, subsequent generations overlapping. Studies of egg-parasites of *S. nivella*, which appear at the end of June, indicated that the borer might be effectively controlled by them. *Tanymecus sciurus*, Ol., damaged the leaves of cane, and heavy infestations of *Pseudococcus* spp. occurred in ratoon canes. In the course of studies of sucking insects found on cane to determine their connection with the transmission of mosaic and streak diseases, negative results have hitherto been secured with *Aphis sacchari*, Zehnt., *Proutista* (*Assamia*) *moesta*, Westw., and *Neomaskellia bergi*, Sign. *Aphis maidis*, Fitch, which causes mosaic in other countries, has been identified on *Sorghum* and maize.

Cotton shoots were badly affected by *Pseudococcus corymbatus*, Green, which was parasitised by *Gitonides perspicax*, Knab [*R.A.E.*, A, iii, 247]

This Drosophilied fly was also bred from *Monophlebus stebbingi* var. *octocaudatus*, Green. Continued studies of the habits and life-history of the Braconid (? *Loxocephalus* sp.) parasitic on adults of *Myllocerus undecimpustulatus* var. *maculosus*, Desbr. (cotton white weevil) [*R.A.E.*, A, xvi, 358] indicated that the adults are active at Pusa until early April and do not disappear after the first week in February as hitherto believed. The appearance of the larvae differs in the early and late stages, nearly full-grown larvae exhibiting two pairs of leg-like protuberances not usually found in Hymenopterous larvae.

In studies of alternative food-plants of some common insect pests, *Acherontia styx*, Westw., was found on *Millingtonia hortensis*, *Laphygma exigua*, Hb., on *Anagalis arvensis*, *Prodenia litura*, F., on *Rumex maritimus*, *Papilio demoleus*, L., on leaves of *Feronia elephantum*, and *Leucophlebia lineata*, Westw., on leaves of *Imperata arundinacea*. Other pests included : *Bedellia enthrypta*, Meyr., on *Porana paniculata* ; *Acrocercops* sp. mining *Loranthus* leaves ; *Eupterote undata*, Blanch., eggs of which were found on leaves of *Bombax malabaricum* ; *Diacrisia obliqua*, Wlk., on ground-nuts ; *Hellula undalis*, F., on cauliflower and cabbage ; *Brachytrypes portentosus*, Licht., on chillies [*Capsicum*] ; the Pyralid, *Coenodomus hockingi*, Wlsm., on *Feronia elephantum* ; and *Hieromantis ioxysta*, Meyr., mining in the tender leaves of *Schleichera trijuga*. *Ancylis lutescens*, Meyr., and *Meridarchis scyrodes*, Meyr., were bred in numbers from fruits of ber [*Zizyphus jujuba*] and *Gelechia tamaricella*, Zell., from leaves of *Tamarix gallica*. The last-named was heavily parasitised by a Bethylid. Two swarms of *Schistocerca gregaria*, Forsk., visited Pusa in June and July 1927, causing defoliation, however, only to *Ficus religiosa* and *Dalbergia sisso*.

Stored grain was protected against attack by *Calandra* (*Sitophilus*) *oryzae*, L., and Bruchids by the use of mercury vapour, which has been used at Pusa for the last three years without deleterious effects on the health of the consumers. A tin amalgam of mercury was also tried with satisfactory results and without affecting the germinating power of the grain.

Ramachandra Rao (Y.). **Administration Report of the Government Entomologist, Coimbatore, for 1927-28.**—30 pp. Coimbatore [Agric. Res. Inst.], 1928.

Some of the information given in this report is contained in papers previously noticed [*R.A.E.*, A, xvii, 112–114]. *Spodoptera* [*mauritia*, Boisd.] occurred in numbers on rice in May and on the second crop in September-October, and there were several outbreaks of *Cirphis unipuncta*, Haw., on various millets in November, and of *C. albistigma*, Moore, on young rice. Serious damage was caused to young crops of ground-nut, cotton and pulses by *Amsacta albistriga*, Wlk. (red hairy caterpillar).

Cotton pests under investigation in Madras during 1927–28 included *Pempheres* [*affinis*, Fst.] (stem weevil) and the bollworms (*Platyedra* [*gossypiella*, Saund.] and *Earias*). Observations of the life-history of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) (paddy stem borer) confirm the conclusion that heavier infestations are liable to occur where there is overlapping of the second rice crop with the first crop of the following year and where wild rice is available during the summer. Parasitism of the egg-masses was observed to be 34·17 per cent. during December, *Tetrastichus* sp. being the most numerous of

the three parasites present. Experiments in the control of *Calocoris* [*angustatus*, Leth.] on cholam [*Sorghum*] showed little infestation on early sown plots, and any cases of severe attack reported were all traced to irregular sowings.

Experiments with Bordeaux mixture, Burgundy mixture and lime-sulphur on pepper [*Piper nigrum*] showed that while the two last-named sprays were of little use against " pollu " disease or the " pollu " beetle [*Longitarsis nigripennis*, Mots.], few Coccids were found on the vines sprayed with them. Bordeaux mixture gave the same results as in previous years [*R.A.E.*, A, xvi, 54] except that Coccids were not injuriously abundant on the leaves. Adults of *L. nigripennis* were observed feeding on tender flushes in May, and eggs were laid in July, indicating that the beetles probably live through the dry period as adults and begin feeding when the flushes appear. In the course of life-history studies of the pepper gall-fly, numerous specimens of *Cecidomyia malabarensis*, Felt, were reared, but no males were obtained. Work against mango hoppers [*Idiocerus*] included the use of a powerful hand sprayer, giving a straight jet breaking at the tip of the inflorescences about 30–40 ft. high, with which 80 per cent. control of the hoppers was secured. Fruits of *Solanum verbascifolium* were constantly found to be infested by *Dacus ferrugineus incisus*, Wlk., which is a pest of *Citrus* and other cultivated fruits.

Observations on *Hieroglyphus banian*, F. (larger rice grasshopper), which is reported to have caused serious damage to rice in previous years, indicated that the actual extent of the damage in 1927, estimated by taking counts of affected earheads, was 14–16 per cent. Low level areas subject to submersion were most heavily attacked, and in these areas, bagging, etc., is impracticable. A further method of control is the scraping of the bunds to a depth of about 4 inches on the sides and top to remove or cut up the egg-masses. Dusting with Paris green and calcium arsenate was found to be ineffective against *Colemania sphenarioides*, Bol. (Deccan grasshopper). *Antestia cruciata*, F., on jasmine was successfully treated by the application of calcium cyanide dust under small cloth tents. Serious damage was caused by the Capsid, *Disphinctus politus*, Wlk., on betel [*Piper betle*]. The most effective of the control measures tried was dusting with a combination of calcium cyanide and tobacco dust. *Argyria sticticraspis*, Hmps., was found to be mainly responsible for deadheart in sugar-cane, and at a later stage attacks the joints in maturing canes. *Diatraea venosata*, Wlk., was reared in small numbers from top shoots in half-grown canes. *Sesamia inferens*, Wlk., caused damage varying from 0·5 to 6·5 per cent. to ragi [*Eleusine*] in one locality.

Life-history studies of *Scirtothrips dorsalis*, Hood, which has caused serious damage to chillies [*Capsicum*] for a number of years, indicate that the eggs, which are laid in the tissues of the leaves and shoots, hatch in about 5 days. The larvae attack the tender foliage, and after about 7–8 days enter the pre-pupal stage, which lasts 18–24 hours. The pupal stage lasts about 48–56 hours, and the adults begin oviposition in about 3 days. Under insectary conditions the maximum life of the adults was 31 days. The female lays only 2–4 eggs a day. Attacked shoots and leaves become twisted and deformed, and when successive shoots are attacked the plants become stunted and finally dry up. Although heavy rain reduces the number of thrips present, mildew appears to occur in the lacerations produced by them when wet weather prevails. Investigations indicate that *S. dorsalis* has a number of

alternative food-plants, including ground-nut, beans, mango, cotton, etc. Spraying with fish-oil resin soap and tobacco decoction, although effective in nurseries, failed to give good results when applied to transplanted crops.

Eriosoma lanigerum, Hausm. (woolly apple aphis) was successfully controlled on apple by means of soil fumigation with crude para-dichlorobenzene against the root forms, brushing living Aphids on the stems and branches with " flit," and the application of bands of wood tar and linseed oil (2 : 3) diluted with petroleum to the base of the stems to prevent the root forms from crawling up them. Pests of hemp [*Cannabis*] included *Tetranychus telarius*, L., *Amyna octo*, Guen., *Heliothis* (*Chloridea*) *obsoleta*, F., *Nezara viridula*, L., and *Dolycoris indicus*, Stål.

Miscellaneous pests of the year included the Lygaeid, *Aphanus sordidus*, F., on stored ground-nuts ; *Xyleborus fornicatus*, Eichh., and *X. semigranosus*, Bldfd., on tea ; *X. compactus*, Eichh., in twigs of coffee ; *Disphinctus humeralis*, Wlk., on young *Cinchona* ; and the Delphacid, *Nilaparvata sordescens*, Motsch., and the Cixiid, *Nisia atrovenosa*, Leth., seriously damaging young rice and causing development of honey dew and sooty mould.

NGUYÊN-CONG-TIÊU. **Notes sur les insectes comestibles au Tonkin.**—*Bull. écon. Indochine*, xxxi, no. 198, pp. 735–744, 4 pls., 3 figs. Hanoi, 1928.

A detailed account is given of insects constituting part of the regular diet of the poorer classes in Tonkin. These include the Orthoptera, *Oxya velox*, F. (sold at approximately 3d. per lb. of about 1,000 individuals), two species of *Euconocephalus*, *Brachytrypes portentosus*, Licht., and *Gryllotalpa africana*, P. de B. ; the Rhynchota, *Belostoma indica*, Vitalis, and several species of cicadas ; two species of Ephemerids ; the Coleoptera, *Apriona germari*, Hope, and two species of water beetle ; the pupae of honey bees and various other Hymenoptera, including certain ants ; *Bombyx mori*, L., which is eaten in the pupal stage ; and the Pyralid, *Brihaspa atrostigmella*, Moore, the larva of which lives in the terminal buds of a native grass, and is both a rare dainty and a highly prized drug. Silkworm pupae are regularly sold in the Tonkin markets at about 6d. per lb. Many of the species mentioned, such as *O. velox*, are more or less injurious to agriculture.

NAKAYAMA (S.), TANAKA (T.) & MARUTA (S.). **The Woolly Apple Aphis (*Eriosoma lanigerum* Hausmann) in Chosen.**—*Bull. Agric. Expt. Sta. Govt.-Gen. Chosen*, no. 4, 21 pp., 6 pls., 4 figs., 2 maps, 39 refs. Suigen, Korea, October 1928.

Eriosoma lanigerum, Hausm., was introduced into Korea, probably on nursery stock from Japan, about 1904. It is distributed over half the peninsula and is spreading rapidly towards the north and west, and, as it appears to thrive in relatively cold climates, it is probable that in a few years all the apple-growing sections of the country will have become infested. The Aphid infests the trunk and branches of apple trees, and even the roots where the soil is light. In cases of severe infestation the leaves turn yellow and the fruits produced are small.

From experiments carried out during 1925, 1926 and 1927 it is concluded that the average period of reproduction varies from 15 to 49 days, with the shortest periods in the summer and the longest in spring and autumn. The largest number of young produced by one female was 169 and the smallest 14, with an average of 7–8 a day during favourable weather. The adult stage is reached in 10–14 days. In summer the apterous females live for about a month, but the period is prolonged as the temperature decreases, so that late in the autumn it may last for 50 days.

The life-cycle was observed throughout the year in the insectary. The winter is passed in the younger stages in crevices in the bark. In the Suigen district the Aphids become active in late April or early May and collect at the knots produced in the preceding season. The number of generations varies according to the temperature, humidity and other environmental factors, but reproduction continues until October or November. In the insectary the number of generations varied from 8 to 14. The seasonal series of apterous females is produced parthenogenetically. Winged individuals occur at times during the summer, but only produce wingless progeny. In the autumn, usually between the end of August and the beginning of November, other winged females appear. These seem to rest on the tree for a day or two and take some food. In some cases rapid dispersion takes place during the day, but efforts made to trace the flight of individuals from known colonies were unsuccessful. Their life appears to be very short, the maximum observed being 10 days. They produce wingless males and females that do not feed. These pair, and the females lay a single overwintering egg that hatches in the following spring and produces the wingless stem-mother. In the laboratory the egg stage lasted from 169 to 177 days. All forms and stages of the insect are briefly described.

Natural enemies of this Aphid are rare in Korea, and no parasites have so far been found. The predators, *Chrysopa cognata*, Maclachlan, *Syrphus balteatus*, DeG., and a Coccinellid beetle have been observed, but do not seem to produce any appreciable effect.

Lime-sulphur (5° Bé.) is one of the most effective sprays for use during the winter and early spring while the trees are dormant. For spring, summer and autumn treatment 40 per cent. nicotine sulphate, 1 : 800, is recommended. It should be applied several times during the season when the Aphids become very numerous. With thorough application even greater dilutions may be used with success. Kerosene emulsion (10 per cent.) or fish-oil emulsion may be used as a substitute for lime-sulphur for winter spraying. Home-made fish-oil emulsion is easily prepared but must be mixed thoroughly. It is most effective when applied immediately after it is prepared, as old stocks are likely to break down and cause injury. In Korea this emulsion is painted on the trunk and branches by hand, and when used in this way a dilution of one to ten is recommended. Trees treated with this emulsion often show extensive scorching when strong sunlight occurs continuously after its application. To prevent such damage the trunk and branches should be whitewashed as soon as possible after treatment. Crude oil emulsion may also be used as a dormant spray, but should be diluted at least twenty times. Infested roots should be treated with para-dichlorobenzene at the rate of $\frac{3}{4}$–1 oz. to each tree. During late autumn, winter and early spring the Aphid clusters and galls should be cut from the trees and burned, together with knots on the branches

and rough bark that might conceal colonies. Hydrocyanic acid gas is used for fumigation in some parts of southern Korea. The time available for fumigation is rather short, being the end of March and early April while the buds are still dormant. Some of the tents used are made of native Korean paper, which is very tough and air-tight, and last for three years or more without repair. One incidental effect of fumigation is a slight delay in the opening of the flower buds.

HILL (G. F.). **Notes on** *Plodia interpunctella* (**Indian Meal Moth**).—*J. Council Sci. Ind. Res.*, i, no. 6, pp. 330–340, 4 refs. Melbourne, 1928.

Studies on the life-history of *Plodia interpunctella*, Hb. (Indian meal moth), the most important of the insects attacking Australian currants and raisins, were carried out in Melbourne during 1926–28. Temperatures of 93° F. proved very unfavourable to the development of the eggs, and 100° F. was invariably fatal. The incubation period varied from 1–14 days, the eggs hatching in 1–5 days at 73–97° F., in 5–9 days at 64–68° F., and in 9–14 days at 62–66° F. Humidity appears to have no definite influence on the period of incubation. Records cited from the experiments of various authors tend to disprove the theory that retarded incubation may account for the presence of larvae of markedly varying sizes in the fruit. A careful consideration of the data secured in the present experiments with temperature records taken by Myers in the holds of a vessel carrying Australian dried fruit to London indicates that eggs, if present at the time of shipment from Australia, are unlikely to remain unhatched and viable throughout their passage to England, since the average temperature for a period of 10 days while the vessel was in the tropics was 67–74° F., under which conditions hatching would have taken place within 3–7 days.

Further experiments showed the average length of the egg stage to be 4·54 days, the larval stage 39·72 days and the pupal stage 13·05 days. In the majority of these experiments some moths emerged during the first summer and autumn, leaving a proportion of the larvae to overwinter; but in one case the life-cycle of all the individuals in a batch was completed during the first summer, and in two cases the entire batch overwintered as larvae. Hibernation studies indicated that under natural conditions overwintering takes place in Melbourne in the larval stage only, neither eggs nor pupae developing after a prolonged period of low temperatures. The first pupae were found about the middle of October, and the first moths about a week later. A remarkable variation occurs in the growth of larvae of the same age living in the same fruit under the same conditions, resulting in complete obliteration of the intervals between the appearance of the spring and summer broods. Larvae transferred from a cool incubator (59–71° F.) to a hot one (90–96° F.) were unable to survive the marked rise in temperature for any length of time.

The period of maximum abundance of the moths in Melbourne at room temperatures was observed to be from 7th December to 15th January, and early in April oviposition ceased altogether. In 1927–28 the first moth appeared at the end of October, and the last on 24th April, the late moths showing no inclination to mate or oviposit. The absence of eggs or young larvae of *P. interpunctella* in a consignment

of the new season's crop of raisins and currants examined on 5th May, 11 days after reception in a store at Melbourne, indicates that the moths had ceased to infest clean fruit before the middle of April. A much longer active season was observed, however, by Lyon at Merbein (Victoria), where moths were found as early as September and where it was possible to carry out experiments with eggs in May. Data are given to show the irregularity in the emergence of moths under identical conditions, the first of 28 moths emerging on 14th January and the last on 12th November 1927 from a batch of eggs laid on 21st November 1926. The number of broods of *P. interpunctella* appears to vary considerably according to climatic conditions, but in Melbourne there are two, a spring brood resulting from eggs laid during the preceding summer, and a summer brood the progeny of the former.

A Gamasid mite that began to appear among the moths early in January increased rapidly and infested 100 per cent. of the adults by the middle of March in addition to attacking the eggs. From 12 to 50 of these mites were found on a single insect, and many moths were malformed and incapable of flight owing to the injuries caused by them.

Jarvis (E.). **Annual Report of Entomologist 1927-1928.**—*28th Rep. Bur. Sugar Expt. Sta. Queensland*, pp. 14–19. Brisbane, 1928.

An account is given of the work carried out at the Meringa Sugar Experiment Station during the year ended August 1928. Hand injectors for liquid fumigants, although useful in orchards or small holdings, are not recommended for fumigating large areas such as cane fields. For this purpose a horse-drawn fumigating machine (operating on the lines of a maize planter), which applies dry fumigants such as calcium cyanide and paradichlorobenzene at regular depths and intervals, has been found both expeditious and economical, one man and one horse fumigating about 3 acres of sugar-cane in a day. Cane land has also been successfully fumigated with paradichlorobenzene by using a simple form of manuring machine. The advantage of this method would be that fumigation could be carried out in the ordinary course of routine work when the final dressing of manure is given to the young cane stools.

The increase of *Rhabdocnemis obscura*, Boisd. (weevil borer) having been favoured by conditions brought about by a recent cyclonic disturbance, further liberations were made of the Tachinid parasite, *Ceromasia sphenophori*, Villen., during the period April to August 1928.

In breeding experiments it was found that *Scolia* (*Discolia*) *soror*, Sm., oviposits best in tins of fairly moist sandy soil mixed with a little humus. It parasitises both *Dasygnathus australis*, Boisd., and *Anoplognathus boisduvali*, Boisd., but seems to prefer the former. During May the eggs hatch in six days and the larvae spin cocoons in approximately 11 days. The pupal period of the only individual bred through was 35 days. It was also found that the triungulin larva of *Macrosiagon* (*Emenadia*) *cucullata*, Macl., is able to live for 29 days in confinement without taking nourishment of any kind except a little water. As many as four triungulins were observed inside a single larva of *Campsomeris tasmaniensis*, Sauss., and in other cases triungulins had entered the larvae of *Scolia soror*, but none was reared to the adult stage.

Burns (A. N.). **Report of the Assistant Entomologist at Mackay.**—*28th Rep. Bur. Sugar Expt. Sta. Queensland*, pp. 19–23. Brisbane, 1928.

An account is given of the work carried out at the Central Sugar Experiment Station from January to August 1928. In the central cane-growing areas the root-eating cockchafer grubs are the most serious pests of sugar-cane, but infestation does not appear to be so severe as in the northern cane fields, probably owing largely to the fact that the soil in the Mackay District is either black or greyish and very heavy, whereas in the far North serious infestation is always most marked in the friable red volcanic soils. The principal cane beetles in order of the destructiveness of their larvae are : *Lepidoderma albohirtum*, Waterh., *Lepidiota frenchi*, Blackb., *Anoplognathus boisduvali*, Boisd., *Dasygnathus australis*, Boisd., *Anomala australasiae*, Blackb., and *Pentodon australis*, Blackb.

During July and August an outbreak of *Phragmatiphila truncata*, Wlk. (large moth borer) occurred in several cane fields, the most severe injury being confined to the outer rows and edges of the fields. After the cane was cut, the ratoons became heavily infested, the damage over the whole field being estimated at 20 per cent., whereas in the three outer rows adjoining a road it was as high as 70 per cent. It was demonstrated that control could be effected by cutting out attacked shoots as far below the ground level as possible, provided that they are cut immediately they show signs of wilting, as otherwise the larvae will probably have moved to a fresh shoot. It was often found that a larva would only remain in one shoot for 2–3 days, feeding at first in the main portion above ground level, then eating its way downwards to the point of attachment to the stool. Considerable numbers of army worms were observed in cane fields, principally in low-lying areas. Young ratoon cane seemed to be more subject to attack than plant cane. In the earlier period of attack *Cirphis loreyi*, Dup. (lesser army worm) predominated, but later *C. unipuncta*, Haw. (true army worm) was more numerous. Three unidentified species of Noctuids were taken in association with these species. A list is given of the cane pests reared and of the parasites bred from them. With the exception of *Campsomeris radula*, F., bred from *Lepidoderma albohirtum* and *Lepidiota frenchi*, none of the parasites has been identified.

Mungomery (R. W.). **Report of the Assistant Entomologist at Bundaberg.**—*28th Rep. Bur. Sugar Expt. Sta. Queensland*, pp. 23–26. Brisbane, 1928.

The rainfall in 1927–28 was well above the average, and although the spring months promoted vigorous growth of sugar-cane and were unfavourable to insect attacks, the benefit was minimised to a certain extent by the cooler temperatures during the summer months, and on the higher lands of the Isis district some of the autumn plant cane was killed by the attack of smaller first and second stage cane grubs. The spread of an unidentified fungus that occurred among the larvae of *Lepidiota frenchi*, Blackb., was undoubtedly favoured by the seasonal conditions, and at certain periods the mortality was as high as 20 per cent. An undescribed Dexiid of the genus *Rutilia* has been found to cause a mortality as high as 50 per cent. among the grubs in limited areas in southern Queensland, the hosts so far recorded being *L. frenchi* and *Dasygnathus* sp.

Under comparatively dry conditions the young grubs migrate towards the cane plants in order to obtain an adequate supply of food and moisture, and fumigation carried out at that time kills a fairly high proportion of them. On the other hand, in a very wet year the grubs may live equally well in the interspace, obtaining their moisture from the soil and feeding on the organic matter incorporated in it. The necessity for migration to the cane plants does not therefore arise, and the grubs often live in the interspace for four to six months or longer. Fumigation of the cane stool thus fails to kill them. The stool is always subject to invasion, and this usually occurs when the soil becomes dry. These observations show the need for a second fumigation, for a satisfactory fumigant that is slow in action, or for a poison for incorporation with the soil surrounding the plant that will kill the grubs when they have eaten the contaminated soil.

Experiments to demonstrate that the preponderance of males over females of *Pseudoholophylla furfuracea*, Burm., caught at light traps was not due to conditions of drought were made during 1927, which was a very wet year. The percentage of females caught was 1·1, the percentage for 1926 being slightly less than 1. Among the insects reared, those new to sugar-cane, which are for the most part of secondary importance, comprised the Lamellicorns, *Anoplognathus pallidicollis*, Blch., *Cericesthis pruinosa*, Dalm., and *Haplonyx castaneus*, Macl., and the Psychid, *Plutorectis melanodes*, M. & L.

JARVIS (E.). **Biological Control of Caterpillars attacking Sugar Cane.** —*Queensland Agric. J.*, xxx, pt. 6, pp. 510–511. Brisbane, 1st December 1928.

Among the natural enemies of Lepidopterous larvae several Carabids that occur commonly in sugar-cane fields in Queensland are of economic importance. In captivity *Rhytisternus carpentarius*, Sloane, fed on a variety of insects. Both the adults and larvae of *Chlaenius australis*, Dej., are predacious on the larvae of *Laphygma exempta*, Wlk. [*R.A.E.*, A, xii, 518]. Other beneficial species occurring in cane fields are *C. flaviguttatus*, Macl., *C. ophonoides*, Fairm., and *Aenigma cyaneum*, Cast.

MUNGOMERY (R. W.). **Cane Grub Activity.**—*Queensland Agric. J.*, xxx, pt. 6, pp. 513–514. Brisbane, 1st December 1928.

Paradichlorobenzene, which gives off toxic vapours over a considerable time, is recommended against sugar-cane grubs during the spring, since there may be differences as great as a month or more in the times at which various individuals rise to the surface of the soil to resume feeding. Carbon bisulphide does not remain toxic for many days, but it kills the grubs in a much shorter time. When it was used in December against third stage larvae of *Lepidiota trichosterna*, Lea, a mortality of nearly 100 per cent. was obtained. Paradichlorobenzene was injected at the same time, but heavy rains occurred shortly afterwards, and in a month's time no mortality had taken place and the cane was as damaged as in the untreated rows. Later, after an interval of fine, hot weather, the treated rows looked much greener than the untreated ones, which had been almost entirely killed. Investigation showed that the majority of the larvae had ceased feeding and were in a semi-paralysed condition. Succeeding rains accompanied by a reduction

in temperature prevented further evaporation of the paradichlorobenzene crystals, enabling the grubs to recover and pupate successfully. On account of this and past experience, paradichlorobenzene is not recommended against large third stage larvae when the monsoon season is imminent ; at this time carbon bisulphide is not only cheaper and easier to apply, but causes a higher mortality.

BURNS (A. N.). **Occurrence of the Common Cane Skipper** (*Telicota augias-kreffti* **Macleay**).—*Queensland Agric. J.*, xxx, pt. 6, pp. 521–522. Brisbane, 1st December 1928.

The larvae of the Hesperiid, *Telicota augias-kreffti*, Macleay, which usually feed on blady grass (*Imperata arundinacea*), were unusually abundant in the spring of 1928 on the leaves of young plant and ratoon cane, in one case as many as six larvae being taken from one plant. The eggs, which are deposited singly on the upper surface of cane leaves and shoots, hatch in 6–8 days. The larvae shelter within a portion of leaf rolled and drawn together with threads. The pupal stage is also passed in a rolled leaf and lasts rather less than two weeks. All stages are briefly described.

FROGGATT (J. L.). **The Banana Weevil Borer in Java with Notes on other Crop Pests.**—*Queensland Agric. J.*, xxx, pt. 6, pp. 530–541, 1 pl. Brisbane, 1st December 1928.

In Java bananas are universally grown, but are almost exclusively for local consumption. The Curculionids, *Cosmopolites sordidus*, Germ., and *Odoiporus longicollis*, Ol. (*Sphenophorus planipennis*, Gylh.), apparently attack all varieties of banana, the latter breeding in the stem tissue after the bunch has been cut or after the plant has died, either as a result of attack by *C. sordidus* or from other causes. The habits of *C. sordidus* are apparently similar to those recorded in Queensland, though a slow rate of oviposition was very noticeable where the climatic conditions were hot and humid. *O. longicollis* oviposits in the ends of cut stems or where an injury permits of entry into the centre of the stem. The larvae feed immediately in and around the bunch stalk and later spread through the tissues of the leaf bases. Pupation takes place in a thick, tightly matted cocoon, usually embedded in the tissues of the leaf bases. Field observations indicated that the borers were much more active at altitudes above 1,000 ft., and they were reported to be more destructive during the wet monsoon, which is the cooler part of the year in Java.

No egg parasites of either species were found, but the larvae of the Leptid, *Chrysopilus ferruginosus*, Wied., all stages of which are briefly described, and the larvae and adults of the Histerid, *Plaesius javanus*, Er., were predacious on the larvae and pupae of both species of borer in captivity. Other possible predators are two Histerids, one or two Staphylinids and two Hydrophilids, none of which has yet been specifically identified. The smaller Histerid was fairly common in rotting banana material and also in decaying sugar-palm and papaya stems. The larger species was collected from rotting banana stems. It was more active than *P. javanus*, but in captivity it was not nearly so voracious a feeder on borer larvae.

It is probable that *P. javanus* is generally distributed throughout the Island. The adults were found in the tissue of rotten stems or bulbs, while the larvae were more generally present in rotting stems in which larvae of the borers were, in most cases, active, often in such association with them as to show definitely that they had been actively predacious immediately before they were exposed. In the one case observed the prepupal period lasted 7 days, and the pupal period 14–15 days. In captivity the adults of *P. javanus* attacked and devoured larvae of *Rhynchophorus ferrugineus*, Ol. The length of life of the larvae and adults is evidently fairly long.

Pupae of *Chrysopilus ferruginosus* were collected in the field, and the adults that emerged fed readily on syrup and on the juices of rotting banana stems. Pairing was not observed, and though oviposition took place readily, no eggs matured. The eggs were laid in irregular masses in crevices or borer holes in slightly decaying stems. In the field larvae and pupae were taken in rotten banana stems, generally, but not always, in association with borer larvae. There is no doubt that the larvae are predacious on the larvae of both species of borer, but further study is necessary to determine whether they can develop on decaying plant tissue or are predacious on other larvae. A small Phorid was bred from 1·46 per cent. of the pupae. The larvae emerged about 10–12 days after the host pupae were collected, and the pupal stage lasted about 7 days. The successful methods used in trans-shipping *C. ferruginosus* and *P. javanus* from Java to Queensland are discussed. Notes are given on the other pests of banana in Java and on the pests of other cultivated crops.

HAMMOND (A. A.). **Peach Aphis and Leaf Curl. Spraying Experiments**, —*J. Dept. Agric. Victoria*, xxvi, pt. 12, pp. 728–730. Melbourne. December 1928.

In the course of spraying experiments with ovicides applied in August against the peach aphis [*Myzus persicae*, Sulz.], an emulsion of 1 gal. fuel oil with 20 gals. standard Bordeaux mixture plus ¼ pt. nicotine sulphate gave slightly better results than the other mixtures, though the addition of nicotine sulphate did not increase the efficiency of the spray. The eggs of this Aphid are deposited in the axils and crevices of the fruit buds in late autumn and hatch at the pink bud stage in spring.

NEWMAN (I.. J.). **Report of Economic Entomologist.**—*Ann. Rep. Dept. Agric. W. Aust. 1927–28*, pp. 28–30. Perth, W.A., 1928.

Much of the information in this report has already been noticed from more detailed papers by the author. Insects observed in Western Australia during the year include *Cryptophlebia* (*Argyroploce*) *illepida*, Butl. (false codling moth), on various stone fruits; *Heliothis* (*Chloridea*) *obsoleta*, F. (climbing cutworm), on tomato, stone fruit, apples and wheat; *Sclerobia tritialis*, Wlk., on wheat; *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) (cabbage moth); and *Evergestis rimosalis*, Guen. (turnip moth). *Chrysomphalus* (*Aspidiotus*) *aurantii*, Mask., which is usually controlled by the parasite, *Aphelinus chrysomphali*, Merc., became very numerous in the late summer and autumn. The long dry summer, which reduced the vitality of the trees, favoured the increase of the scale, and the dust that accumulated on the leaves

injured the plant and absorbed the honeydew on which the parasite feeds. *A. chrysomphali* began to increase after the rains in May and is likely to resume control of the scale. *Phthorimaea operculella*, Zell., which caused little loss to potatoes, considerably injured Cape gooseberries, the larvae burrowing into the stems of the plants and causing severe dieback. An unusually serious outbreak of *Thrips tabaci*, Lind., occurred in the spring, and considerable damage was done to fruit-tree blossoms and other flowers.

MEYRICK (E.). **Exotic Microlepidoptera, iii, pt. 15.**—pp. 449–480. Marlborough, Wilts., the author, December 1928. Price, 3*s*. per part.

The new species described include *Cydia* (*Laspeyresia*) *fabivora*, bred from fresh beans in Colombia, and *Aegeria aericincta*, from sweet potato (*Ipomoea batatas*) in Uganda. The male of *Tipulomima* (*Aegeria*) *pyrostoma*, Meyr., is described from two examples bred from sweet potato in Uganda.

THÉRY (A.). **Une nouvelle** *Sphenoptera* **parasite du cotonnier dans la Somalie italienne.**—*Ann. Mus. Stor. nat.*, lii, pp. 290–292, 1 fig. Genoa, 1928.

The Buprestid, *Sphenoptera scebelica*, sp. n., is described from Italian Somaliland, where it is said to be a serious pest of cotton.

Plants (Injurious Pests) Ordinance, 1923. Order, no. 44 of 1926.—2 pp. Accra, 30th November 1926. [Recd. March 1929.]

Cola and banana plants are " declared plants " under this Ordinance [*R.A.E.*, A, xii, 112].

TOOKE (F. G. C.). **A Borer Pest of Eucalypts. The destructive** *Phoracantha* **Beetle and its Control.**—*Fmg. S. Afr.*, December 1928, reprint no. 79, 5 pp. Pretoria, 1928.

Phoracantha semipunctata, F., the only species of the genus known in South Africa, was probably introduced in newly-cut railway sleepers from Australia about 30 years ago, and has been disseminated throughout the Union by the traffic in *Eucalyptus* logs. As in Australia, it is chiefly the dead and sickly *Eucalyptus* trees that are attacked, though larvae sometimes attack healthy trees also. In this case, when numbers are present, the cambium may be entirely eaten away, and the tree then has no chance of recovery. The eggs are usually deposited separately beneath thin strips of bark in irregular rows. Oviposition occurs from early November to late April. The young larvae bore their way through the bark and remain for from 3 to 5 months feeding on the inner bark and sapwood. After completing their growth, the larvae bore obliquely from 4 to 6 inches into the wood and remain in the tunnel through the winter, pupating at the approach of warm weather. The adults emerge from early November to early April, cutting their way through the bark. Many young larvae are drowned in the gum exuded from healthy trees when attacked. A parasite has been reared from the eggs, but its value is negligible. An attempt will probably be made to introduce other natural enemies from Australia. Artificial control measures have become increasingly necessary in the

last few years, as *P. semipunctata* has largely become a secondary pest on *Eucalyptus* previously attacked by *Gonipterus scutellatus*, Gyll., which destroys the crown and defoliates the trees. In Government plantations, trap trees are felled between November and April and the larvae in them destroyed in the following summer. Other measures include stripping the bark off trees immediately after felling, while it is still green, as without the protection of the bark the larvae quickly perish, and prompt utilisation of dying, dead or felled trees. In particular, it is essential to make a thorough clearance of all dead and dying trees in winter and early spring over large areas.

[Ripley (L. B.).] **Disposal of Waste Fruit.**—*Fmg. S. Afr.*, December 1928, reprint no. 84, 1 p. Pretoria, 1928.

The proper disposal of waste fruit is the most important measure in controlling fruit-flies, and is also of value against the false codling moth [*Argyroploce leucotreta*, Meyr.] and the codling moth [*Cydia pomonella*, L.]. The processes recommended are the collection of all fallen fruit daily and its burial under at least two feet of soil pounded down to a compact surface. Where soil is hard or shaley, an alternative treatment is to soak the fruit in a carbolic sheep dip diluted 1 : 600 for 3 or 4 days, standing the fruit in tubs with perforated bottoms placed inside half-barrels, so that the liquid can drain off into the tubs and be used many times. Fruit so treated can be left on the ground to rot, burying being unnecessary. Waste fruit can also be soaked in water for a week; this will kill all maggots in deciduous fruit, but there must be at least as much fruit as water in the tubs to ensure a sufficiently high concentration of acids, etc., to be certain of killing the maggots. It is not known whether a week would be long enough for the treatment of *Citrus* fruit. Fruit treated with water can subsequently be used as food for poultry or pigs. Infested fruit may be used without treatment as food for pigs or poultry, but only in such quantities as can be immediately consumed.

Garrigues Martínez (J.). **Empleo del nitrato de Chile para combatir el piojo rojo del naranjo.** [The Use of Chile Nitrate against the Red Scale of Orange.]—*Bol. Agric. téc. econ.*, Sec. doctrinal, xx, no. 239, pp. 563–565. Madrid, 30th November 1928.

A plantation in Almeria of 350 small orange trees was freed from a very severe infestation by the red scale [*Chrysomphalus*] by six applications, begun early in April 1928 and repeated at 12–15 day intervals, of a spray containing 11 lb. sodium nitrate in 40 gals. water. As careful examination resulted in a leaf being found with one living and one dead scale, a few further applications were advised. The total cost of the six applications was about 2½*d.* a tree.

Marchal (P.). **Empleo de los portainjertos resistentes al pulgón lanígero del manzano.** [The Use of Stocks resistant to the Woolly Aphis.]—*Bol. Agric. téc. econ.*, Sec. doctrinal, xx, no. 239, pp. 566–572. Madrid, 30th November 1928.

This is a survey of the use of apple stocks, such as Northern Spy, that are resistant to attack by the woolly apple aphis [*Eriosoma lanigerum*, Hausm.].

DEL CAÑIZO (J.). **Las plagas de** *Ocnogyna baetica*, **Ramb., en el Sur de España.** [Infestations by *O. baetica* in the South of Spain.]—*Bol. Pat. veg. Ent. agric.*, iii, no. 10–11, pp. 8–16, 2 figs., 8 refs. Madrid, June 1928.

The larvae of the Arctiid, *Ocnogyna baetica*, Ramb., which attack a great variety of plants of different natural orders, may be seen during winter on weeds round fields and along roads in Andalusia, and occasionally invade the fields, causing considerable loss, particularly to artichoke, potato, cabbage, etc. Sometimes they attack the shoots of vines and fruit trees. A brief description of the larval, pupal and adult stages of this moth is given. The larval webs generally appear about mid-November, being spun by a colony on occupying a new site. The larvae separate after the third moult, about mid-January, living singly on the various food-plants. They pupate in March, or after very cold winters in April, in cocoons buried in the vegetable débris on the ground. The adults emerge from September to November. The female lays 300–400 eggs in one mass, and the larvae hatch in 2–3 weeks.

This moth is usually very localised owing to the female being wingless, but is spread by the wind, which carries the abdominal hairs containing eggs. In Spain it is checked by flacherie, a fungus of the genus *Entomophthora*, a Tachinid, and possibly an Ichneumonid. In Italy two Braconids, *Apanteles congestus*, Nees, and *Rhogas geniculator*, Nees, have been recorded from it. The larval colonies may be destroyed by burning the plants or by using a gasoline torch.

DEL CAÑIZO (J.). **Una amenaza para el cultivo de la patata : El "escarabajo del Colorado."** *Leptinotarsa decemlineata* (**Say**). [A Menace to Potato Cultivation : The Colorado Beetle.]—*Bol. Pat. veg. Ent. agric.*, iii, no. 10–11, pp. 36–41, 4 figs. Madrid, June 1928.

In view of the possibility of its introduction into Spain, an account is given of *Leptinotarsa decemlineata*, Say, and its occurrence in France.

El servicio de consultas sobre plagas y enfermedades de las plantas cultivadas en el año 1927. [The advisory Service on Pests and Diseases of cultivated Plants in Spain in 1927.]—*Bol. Pat. veg. Ent. agric.*, iii, no. 10–11, pp. 45–58. Madrid, June 1928.

A list is given of the various pests and diseases regarding which advice was sought in 1927 from the various phytopathological stations in Spain.

MEIER (K.). **Zur Arsenfrage.** [The Arsenical Question.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 26, pp. 455–461. Wädenswil, 22nd December 1928.

Analysis of fruit from trees treated with the usual arsenical sprays in Switzerland, the results of which are discussed in detail, showed that the arsenic residue was always very considerably less than the amount tolerated on fruit imported into England.

Tests were carried out during two seasons with sprays of lead arsenate and calcium arsenate, which proved to be equally effective in the control

of *Cheimatobia brumata*, L., and the codling moth [*Cydia pomonella*, L.] on various fruit trees. Calcium arsenate did not scorch the leaves and is therefore preferred.

SCHMID (G.). **Vergleichende Versuche mit Bleiarseniat und Kalkarseniat.** [Comparative Tests with Lead Arsenate and Calcium Arsenate.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 26, p. 461. Wädenswil, 22nd December 1928.

In comparative spraying tests calcium arsenate proved as effective as lead arsenate against *Hyponomeuta malinellus*, Zell. Against *Cydia pomonella*, L., lead arsenate appeared to be slightly more effective, and it also has an indirect effect on apple scab, as it apparently increases the adhesiveness of lime-sulphur.

WIESMANN (R.). **Untersuchungen zur Biologie und Bekämpfung des Apfelblütenstechers, *Anthonomus pomorum*, L.** [Observations on the Biology and Control of *A. pomorum*.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 26, pp. 480–491, 4 figs., 6 refs. Wädenswil, 22nd December 1928.

In Valais *Anthonomus pomorum*, L. (apple blossom weevil) appears in the spring at the time of the swelling of the buds, on which the adults feed for about 3 weeks before they become sexually mature. The eggs are laid in the inflorescences. The infestation was considerably reduced by the application of 8 per cent. fruit-tree carbolineum, as the spray retards the development of the buds and is repellent to the weevils.

PAPERS NOTICED BY TITLE ONLY.

LEI (H. K.). **Silkworm Diseases in South China.**—*China J.*, x, no. 1 pp. 30–37, 8 refs. Shanghai, January 1929. [*Cf. R.A.E.*, A, xvi, 626.]

BETREM (J. G.). **Monographie der indo-australischen Scoliiden (Hym. Acul.) mit zoogeographischen Betrachtungen.** [A Monograph on the Indo-australian Scoliids, with zoogeographical Notes.]—*Treubia*, ix, suppl., 388 pp., 5 pls., 29 figs., 1 map, 347 refs. Buitenzorg, January 1928.

DE AZEVEDO MARQUES (L. A.). **Cigarrinha nociva a varias especies vegetaes. Biologiado me mbracideo *Aethalion reticulatum* (L.).** [The Biology of the Membracid, *A. reticulatum*, injurious to various Plants.]—*Bol. Inst. biol. Defesa Agric., Minist. Agric. Ind. e Comm.*, no. 6, 29 pp., 4 pls. Rio de Janeiro, 1928. [*Cf. R.A.E.*, A, xiii, 492.]

DINGLER (M.). **Ueber das Generationenschema der Pflanzenläuse.** [On the diagrammatic Representation of Generations in Aphids.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 390–393, 3 figs., 1 ref. Berlin, November 1928. [*Cf. R.A.E.*, A, xv, 420.]

ROEPKE (W.). **Ueber die Anfertigung mikroskopischer Präparate von Blattläusen (Aphididen).** [On Microscopical Preparations of Aphids.]—*Anz. Schädlingsk.*, iv, pt. 12, pp. 160–161, 1 ref. Berlin, 1928.

KOTLÁN (A.). *Diplogaster brevicauda* **n. sp., a possible Nematode Parasite of the Larvae of** *Pyrausta nubilalis*.—*Internat. Corn Borer Invest. Sci. Rep. 1927–28*, pp. 179–183, 2 figs., 6 refs. Chicago, Ill., 1928.

URICH (F. W.). **The Sugar-cane Froghopper** [*Tomaspis saccharina*, Dist.]. **(Issued for use in Elementary Schools.)**—8 pp., 9 figs. Trinidad, Froghopper Investigation Committee, 1928.

Spreng (H.). **Grossversuche zur Bekämpfung des Frostspanners, des Knospenwicklers und der Schrotschusskrankheit.** [Large-scale Experiments in the Control of the Winter Moth, the Bud Moth, and Shot-hole Disease.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 26, pp. 494–497, 4 figs. Wädenswil, 22nd December 1928.

Cherries are an important crop in parts of the Swiss canton of Bern, but of recent years the winter moth [*Cheimatobia brumata*, L.], bud moths and shot-hole disease have caused serious losses. The value of spraying was clearly shown by tests made in 1928, when treated cherry trees produced a crop two to three times heavier than any of the untreated ones, the majority of which did not yield anything. Four sprays were applied, *viz.*, 5 per cent. carbolineum on 20th March ; 3 per cent. lime-sulphur and 2 per cent. lead arsenate on 9th and 10th April (pre-blossom) ; 2 per cent. lime-sulphur and 2 per cent. lead arsenate on 3rd and 4th May (post-blossom) ; and 2 per cent. lime-sulphur on 26th and 28th May.

Maag (R.). **Untersuchungen über Winter- und Sommerbespritzung im Heimgarten Bülach 1928.** [Investigations on Winter and Summer Spraying at Heimgarten near Bülach.]—*Schweiz. Z. Obst- u. Weinb.*, xxxvii, no. 26, pp. 498–509, 5 figs. Wädenswil, 22nd December 1928.

In the course of tests of various sprays in apple orchards it was found that fruit-tree carbolineum at a strength of 8–10 per cent. was the only insecticide successful against the woolly aphis [*Eriosoma lanigerum*, Hausm.], which occurred in large numbers in 1928 ; 5 per cent. was insufficient in many cases.

van der Meulen (J. G. J.). **Voorloopig onderzoek naar de specialisatie en de infectiebronnen der mosaiekziekten van landbouwgewassen.** [A preliminary Investigation on the Specificity and the Sources of Infection of Mosaic Diseases of Agricultural Plants.]—*Tijdschr. Plantenziekt.*, xxxiv, no. 5, pp. 155–176, 14 refs. Wageningen, May 1928.

This is an account of experiments undertaken in Holland to ascertain whether certain mosaic diseases infect various plants or whether each plant has its own specific mosaic. *Myzus persicae*, Sulz., transmitted the mosaic diseases of potato, beet, swedes, rape, white clover, and *Solanum nigrum*, but the only cross-transmissions that succeeded were from potato to *S. nigrum* and probably to white clover ; and from white clover probably to red clover. *Aphis rhamni*, Boy., transmitted mosaic of white clover and of *Cirsium arvense*, and in the case of the former probably infected potato and red clover. *Amphorophora* (*Rhopalosiphum*) *viciae*, Kalt., transmitted mosaic of broad beans. Attempts to transmit all these diseases to other plants proved unsuccessful, and the conclusion is reached that mosaic diseases are specific, except for the fact that there is a possibility of white clover being a source of infection for potato. It is evident that all Aphids are not equally capable of being vectors.

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Blunck (H.), Bremer (H.) & Kaufmann (O.). **Untersuchungen zur Lebensgeschichte und Bekämpfung der Rübenfliege** (*Pegomyia hyoscyami* **Pz.). 1. bis 8. Mitteilung.** [Investigations on the Life-history and Control of the Beet-fly. Communications 1 to 8.] —*Arb. biol. Reichsanst. Land- u. Forstw.*, xvi, no. 3, pp.423–573, 30 figs., 3 maps, numerous refs. Berlin, October 1928.

This series of reports is based on several years' work, begun in 1924, on *Pegomyia hyoscyami*, Panz., a serious pest of sugar-beet in Germany. Further papers will be issued singly as occasion warrants.

In the first communication, Blunck states that experience gained in recent years in experimental stations by the Imperial Biological Institute shows the value of mobile units in solving difficult problems quickly. Stress is laid on the absolute necessity for constant attention by a trained observer capable of following each phase of an outbreak.

The second, third and sixth papers by Bremer give accounts of the infestation by *P. hyoscyami* in North Pomerania and the island of Rügen in the years 1924, 1925 and 1926. It was found that Kleine's rule of a given total amount of stored heat in the ground causing emergence from the overwintering pupae [*R.A.E.*, A, xii, 71] fails if the weather varies from the normal. The summer of 1925 was warm, thus favouring the natural enemies of the fly. Consideration of the temperatures and infestations from 1919 onwards indicated that in these regions a cool summer favours the fly, apparently by checking its enemies. The resultant prediction of a decline of the infestation in 1926 was largely fulfilled.

The fourth, fifth and eighth papers, by Kaufmann, report on the infestations in Silesia in 1925, 1926 and 1927. The seventh paper, by Bremer and Kaufmann, deals with the natural enemies of *P. hyoscyami*, of which those of some importance have been noticed [A, xiv, 220, 312]. While the abundance of the pest is largely correlated with that of its natural enemies, there is little prospect of artificially increasing their value.

P. hyoscyami is usually recorded as having three generations a year in Germany, and this number was observed in Pomerania, the flies being numerous in May, July and August. In Silesia, four generations occurred in 1925 and 1926, in May, June, July–August and September, but there were only three in 1927. The fourth generation is only a partial one. The eggs are laid on the beet leaves, in which the larvae mine, even the heart-leaves being destroyed in cases of severe infestation. The effect of the injury is intensified by hot sunshine, which causes withering. Pupation takes place in the ground.

Werth (E.) & others. **Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1927.** [Diseases and Injuries of Cultivated Plants in 1927 in Germany.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 37, 212 pp. Berlin, November 1928.

This report contains annotated lists of the insect pests recorded in Germany in 1927, divided according to the class of crop attacked.

Akenhead (D.). **Viticultural Research.**—*E.M.B. 11*, 70 pp., 91 refs. London, H.M.S.O., November 1928. Price 1*s.*

In this memorandum, issued by the Empire Marketing Board, the section dealing with insects gives notes on the more important pests

of vines and their control, the information being obtained from the literature and by the author during a tour made just before the 1927 harvest through certain of the best-equipped viticultural districts in Italy, France and Germany.

KAMNER (A.). **Die Maikäferschwarmjahre in Siebenbürgen.** [Swarming Years of May Beetles in Transylvania.]—*Verh. siebenbürg. Ver. Naturw.*, lxxviii, wiss. Teil 1, pp. 11–28, 1 map, 14 refs. Hermannstadt, 1928.

In Transylvania *Melolontha melolontha*, L., and *M. hippocastani*, F., swarm every three years, in April and May. A table is given to show the years of swarming, noted from 49 observation stations over a period of 34 years. Oviposition takes place about three weeks after the adults emerge. The eggs are laid in two groups, with some days interval between them. Destruction of foliage by the beetles occurs, therefore, in April–June. They attack forest and fruit trees, and are especially destructive to sugar-beet and potatoes. The larvae destroy the roots of sugar-beet, potatoes, cereals, etc., causing most damage in the second year of their development. They pupate in the soil in July or August.

The natural enemies of *Melolontha* include various insectivorous birds and mammals, particularly rooks and moles, as well as Carabids and the parasites, *Dexia rustica*, F., *D. vacua*, Fall., *Dexiosoma caninum*, F., *Microphthalma disjuncta*, Wied., and *Muscina* (*Cyrtoneura*) *stabulans*, Fall. Dusting the ground thickly with quick-lime in dry weather destroys large numbers of the beetles, which may also be shaken from trees and bushes. Deep ploughing will destroy many larvae.

SCHOYEN (T. H.). **Beretning om skadeinsektenes optreden i land- og havebruket i arene 1926 og 1927.** [Report on Insects injurious to Agriculture and Horticulture in 1926 and 1927.]—44 pp., 32 figs. Oslo, 1928.

Pests recorded in Norway in 1926–27 and not mentioned in previous reports [*R.A.E.*, A, xv, 235–237] include: *Macrosiphum granarium*, Kirby (*Siphonophora cerealis*, Kalt.), on winter wheat and oats; *Cicadula sexnotata*, Fall., *Blitophaga* (*Silpha*) *opaca*, L. (which also attacked beet and spinach), and *Phyllotreta* (*Haltica*) *vittula*, Redtb., on barley; *Lema melanopa*, L., on oats and barley; and *Cetonia aurata*, L., on rye. An unusually severe outbreak of wireworms occurred in 1926, barley being particularly attacked, but the cold spring of 1927 checked the infestation. Grasses were attacked by *Phyllopertha horticola*, L., *Hepialus lupulinus*, L., *Crambus hortuellus*, Hb., *Oligotrophus alopecuri*, Reut., and *Pediculopsis* (*Pediculoides*) *graminum*, Reut.; peas by *Macrosiphum* (*Illinoia*) *pisi*, Kalt., and *Polia* (*Mamestra*) *pisi*, L.; beans by *Aphis fabae*, Scop.; potatoes by *Lygus pabulinus*, L., and *Polia* (*Mamestra*) *oleracea*, L.; tomatos by *P. oleracea* and *Tachycines asynamorus*, Adel.; cabbage by *Contarinia torquens*, de Meij.; cucumbers by *Thrips nigropilosus*, Uzel, and *Trogophloeus pusillus*, Grav.; and hops by *Vanessa urticae*, L. The mites, *Uropoda obnoxia*, Reut., and *Tetranychus telarius*, L. (*althaeae*, von Hanst.) occurred on cucurbits, etc., in hot-houses.

Pests of apple included *Taeniothrips inconsequens*, Uzel, *Psylla mali*, Schmidb., *Anuraphis* (*Aphis*) *crataegi*, Kalt., *Byturus tomentosus*, F.,

Phalera bucephala, L., *Poecilocampa populi*, L., *Eriogaster lanestris* var. *aavasakae*, Teich, *Chloroclystis rectangulata*, L., *Biston hirtaria*, Cl., *Hybernia aurantiaria*, Esp., *Anisopteryx aescularia*, Schiff., *Hyponomeuta padellus*, L., *Cemiostoma scitella*, Zell., and *Coleophora nigricella*, Stph. Other orchard pests were *Phyllopertha horticola*, L., *Argyroploce* (*Olethreutes*) *variegana*, Hb., and *Eucosma* (*Tmetocera*) *ocellana*, Schiff., on pears; *Anuraphis helichrysi*, Kalt. (*Aphis pruni*, auct.), *Hyalopterus arundinis*, F. (*pruni*, F.), *Xyleborus dispar*, F., and *Eriophyes similis*, Nal., on plums; *Lecanium corni*, Bch., and *Argyresthia ephippiella*, F. (*pruniella*, auct.), on plums and cherries; and *Myzus* (*Myzoides*) *cerasi*, F., on cherries. *Capitophora* (*Myzus*) *ribis*, L., and *Pulvinaria betulae*, L., occurred on red currants, and *Lecanium corni*, Bch., on gooseberries and raspberries. Among other pests of bush fruit, *Aphis grossulariae*, Kalt., appeared locally in large numbers, and a serious attack of *Bryobia ribis*, Thomas, was observed in 1926. *Eriophyes ribis*, Nal., occurred on black currants, *Amphorophora* (*Siphonophora*) *rubi*, Kalt., and *Pennisetia* (*Sesia*) *hylaeiformis*, Lasp., on raspberry, and *Philaenus spumarius*, L., on raspberry and strawberry.

Bovien (P.). **Blommehvepsen og Paerehvepsen** (*Hoplocampa fulvicornis* **og** *H. brevis*). [Plum and Pear Sawflies.]—*Gartner-Tidende*, 1928, reprint 2 pp., 3 figs. Copenhagen, 1928.

Sawflies attacking fruit trees in Denmark include *Hoplocampa testudinea*, Klug, on apples, *H. fulvicornis*, Panz., on plums, and *H. brevis*, Klug, on pears. The information given on *H. fulvicornis* is similar to that already noticed [*R.A.E.*, A, xvii, 59]. Observations on the life-history of *H. brevis* were carried out in 1928. Pupation takes place in the ground, the adults emerging during May. Ovipositing females observed under glass invariably laid their eggs on the blossom of pear. The larvae, which hatched in 5–6 days, at first mined superficially in the young fruits, but later riddled them completely. When one pear is destroyed, the larva migrates to another, but the number of pears that can be destroyed by one larva has not yet been determined. The first larva was observed to enter the ground to pupate on 10th July. Many young pears that had been infested were found on the ground beneath the trees.

[Chorbadzhiev (P.).] **Чорбаджиев (П.). [Reports on Pests of cultivated Plants in Bulgaria during 1926.]** [*In Bulgarian.*]—*Rapp. ann. Sta. agron. Etat Sofia 1926*, pp. 175–241, 5 refs. Sofia, 1928.

Notes are given on the injurious insects recorded during 1926 from various parts of Bulgaria, of which those mentioned below are the most important, and in many cases on measures for their control. *Porthetria* (*Lymantria*) *dispar*, L., caused serious damage to oak, ash, maple and hornbeam in mountains near Burghas, about 76 per cent. of the trees being defoliated. Some of the larvae and cocoons were destroyed by the larvae of *Calosoma sycophanta*, L., and *Dermestes lardarius*, L. The parasites observed were *Theronia atalantae*, Poda, *Monodontomerus aereus*, Wlk., *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), *Perilampus* sp., *Brachymeria* (*Chalcis*) *intermedia*, Nees, *Sturmia inconspicua*, Mg. (*bimaculata*, Htg.), and *Anastatus disparis*, Ruschka, the last named attacking the eggs.

Other forest pests included *Chermes viridis*, Ratz., *Thaumetopoea pityocampa*, Schiff., *Rhyacionia* (*Evetria*) *buoliana*, Schiff., *Pissodes pini*, L., *Hylobius abietis*, L., *Myelophilus minor*, Htg., and *M. piniperda*, L., on conifers; *Tetraneura ulmifoliae*, Baker (*ulmi*, DeG.), and *Pteleobius vittatus*, F., which in some districts has two generations a year, but in the Sofia region only one, on elms; *Lytta vesicatoria*, L., and *Hylesinus* (*Leperisinus*) *fraxini*, Panz., on ash, the former species also attacking oak; and *Melasoma vigintipunctata*, L., *Phyllobius oblongus*, L., and *P. argentatus*, L., on willow.

Orchard pests included *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., *Hyponomeuta malinellus*, Zell., and *Scolytus* (*Eccoptogaster*) *mali*, Bechst., on apples; *Psylla pyricola*, Först., and *Aspidiotus ostreaeformis*, Curt., on pears; *Aphis pomi*, DeG., on apples and pears; *Eriophyes phloeocoptes*, Nal., *Anuraphis helichrysi*, Kalt. (*Aphis pruni*, auct.), *Lecanium corni*, Bch., *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, L.), and *Hoplocampa fulvicornis*, Klug, on plums; *Cydia* (*Carpocapsa*) *pomonella*, L., which has three generations a year in Bulgaria, on apples, pears and plums; *Blitopertha lineolata*, Fisch., on pears and plums; *Cetonia aurata*, L., and *Rhagoletis* (*Spilographa*) *cerasi*, L., on cherries; *Eurytoma amygdali*, Endl., on almond; and *Aporia crataegi*, L., *Epicometis hirta*, Poda, *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., and *S.* (*E.*) *amygdali*, Guér., which occurred on various fruit-trees, the last-named especially on stone-fruits.

Vines were attacked by *Eriophyes vitis*, Nal., *Opatrum sabulosum*, L., and *Amphimallus solstitialis*, L. Other vine pests were *Euxoa* (*Agrotis*) *segetum*, Schiff., and *E.* (*A.*) *tritici*, L., which, together with *Thrips tabaci*, Lind., also attacked tobacco.

Omophlus lepturoides, F. (*betulae*, Hbst.) occurred on vines and rye. Other cereal pests included *Chlorops taeniopus*, Mg., on wheat; *Limothrips* (*Thrips*) *cerealium*, Hal., on rye and wheat; *Zabrus tenebrioides*, Goeze, and *Anisoplia austriaca*, Hbst., on rye, wheat and barley; *Agriotes lineatus*, L. (*segetis*, Bjerk.), on wheat and barley; and *Lema melanopa*, L., on oats.

Miscellaneous pests included *Pyrameis cardui*, L., on peas and beans; *Bruchus pisorum*, L. (*pisi*, L.), on peas; *Entomoscelis adonidis*, Pall., on rape; *Phytodecta sexpunctata*, Panz., on lucerne; *Sitona lineata*, L., and *Pseudotrematodes frivaldszkyi*, Men., on vetch; *Hylemyia* (*Anthemyia*) *antiqua*, Mg., on onions; the Cephid, *Syrista parreyssi*, Spin., on roses grown for essence; and *Sitrotoga cerealella*, Ol., and *Calandra granaria*, L., in stored products.

The Breeding of beneficial Parasites. *Science*, lxix, no. 1780, p. 152. New York, N.Y., 8th February 1929.

A brief account is given of the work of the laboratory for breeding beneficial parasites, recently established in England by the Empire Marketing Board and under the control of the Imperial Bureau of Entomology. Consignments of insects have been sent to various parts of the Empire, including parasites of the pine tortrix [*Rhyacionia buoliana*, Schiff.], the greenhouse whitefly [*Trialeurodes vaporariorum*, Westw.], and a Coccid [*Lecanium coryli*, L.] to Canada; *Rhyssa* [*persuasoria*, L.], a parasite of *Sirex*, to New Zealand; three species of parasites of the pear-slug [*Caliroa limacina*, Retz.], collected chiefly in northern France, to New Zealand and Australia; a parasite

[*Aphelinus mali*, Hald.] of the woolly apple aphis [*Eriosoma lanigerum*, Hausm.] to India and Kenya; and parasites of the earwig [*Forficula auricularia*, L.] to New Zealand and Canada.

FISHER (R. C.). *Lyctus* **Powder-post Beetles.**—*Dept. Sci. Indust. Res. Forest Prod. Res. Bull.*, no. 2, 46 pp., 29 figs., 37 refs. London, H.M.S.O., 1929. Price 3*s.* net.

During the last few years the furniture industry in England has suffered greatly from the depredations caused by powder-post beetles (*Lyctus* spp.), and owing to the gravity of the situation in the High Wycombe district, an investigation was undertaken at the Forest Products Research Laboratory at Princes Risborough, the first stages of which are recorded in this report. A detailed account is given of the life-history of a typical *Lyctus* beetle, of the nature of the damage caused by it in stored timber, and of the measures that are being considered and have been to some extent carried out to prevent the losses caused. A great deal of the information has already been noticed [*R.A.E.*, A, xvi, 139, 183, 585, 586, etc.]. The beetles have never been known to attack coniferous timber; oak, ash, sweet chestnut and walnut suffer most severely in England. Maple, sycamore and willow have been reported to be attacked in other countries, but in the present investigations neither these nor other small-pored timbers such as beech and birch were found to be infested. In the laboratory, oak exposed to *Lyctus* within 2 or 3 weeks of felling was attacked and became infested; the optimum conditions for attack and development appear to be at an early date after felling, but what these conditions are, when they first appear and how long they persist are at present only partly known. A prolific source of re-infestation is the consignments of American oak and ash that are infested before introduction into Britain.

Control and remedial measures are discussed at length. The results of kiln-treatment experiments confirm those previously recorded [*R.A.E.*, A, xiii, 45] except that the actual lethal temperature is apparently slightly lower than 130° F. Larvae were killed by exposure, in a saturated atmosphere, at a temperature of 125° F. maintained for 50 minutes. Allowance must be made for the heating of the wood in the kiln to the temperature of the kiln, and the time requisite for this varies with the thickness and other conditions of the timber under treatment. When the required heat has penetrated all the timber in the kiln, the lethal treatment may be considered to commence, live steam being blown into the kiln and the temperature maintained at 130° F. for a further period of 1½ to 2 hours, with the humidity of atmosphere in the kiln at saturation point. A table shows the variation in time required for treatment according to thickness of the timber. Experiments are now in progress in which zinc chloride is being used to protect timber against attack by *Lyctus*; the results will be published later. Staining or varnishing and polishing wooden furniture prevents attack, as does paraffin wax thinly coated over cut surfaces of the wood. A mixture that has been recommended for brushing or spraying infested furniture consists of 91 per cent. orthodichlorobenzene, 7 per cent. white Castile soap and 2 per cent. cedar wood oil. It is hoped to work out a technique by which heat sterilisation and impregnation of timber with a suitable insecticide can be carried out in one operation.

Notes are added on heat sterilisation of timber in relation to kiln seasoning, by S. T. C. Stillwell, and on vessel size and the liability of woods to *Lyctus* attack, by S. H. Clarke [*R.A.E.*, A, xvi, 586], and appendices deal with experimental notes on *L. brunneus*, Steph., heat penetration experiments, diagnostic features of dust of LYCTIDAE and ANOBIIDAE, and wood-boring insects associated with *Lyctus*.

PETHERBRIDGE (F. R.) & TUNNINGTON (F.). **The Control of Apple Sawfly.**—*J. Minist. Agric.*, xxxv, no. 11, pp. 1055–1059. London, February 1929.

An account is given of experiments carried out in 1927 and 1928 with a spray, consisting of 4 oz. nicotine (95–98 per cent.), 4 lb. soft soap and 40 gals. water against *Hoplocampa testudinea*, Klug (apple sawfly). The weight of apples obtained from the sprayed trees was considerably increased, and the following recommendations are made from the data obtained. In the case of a severe attack on a small area that can be sprayed in two or three days, the first application should be made 5–6 days after the petals have fallen, and the second 7 days later. On a large acreage where the application would take rather more than a week, spraying should be begun as soon as the petals fall and the second spraying 7–10 days later. In the experiments, one spraying on a badly attacked crop ensured a good yield. In the case of a moderate infestation, one spraying during the fortnight following the petal fall should give satisfactory results and should also be of value in reducing Capsids and Aphids. Where the water is hard more soft soap may be needed, or where it is too hard to use soft soap, some other spreader such as Agral I [*R.A.E.*, A, xvi, 585] or casein-soda should be substituted. If nicotine is added to a fungicide, the results are often disappointing, as the amount of spray applied as a fungicide is so very much less than that applied as a contact spray.

POISSON (R.). **Sur la présence dans le midi de la France d'un Hemiptère Homoptère américain de la famille des Membracidae : *Ceresa bubalus* Fab., et sur sa biologie.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 8, pp. 572–573, 1 ref. Paris, 1929.

Ceresa bubalus, F., is recorded from the south of France, where it is liable to become a pest of cultivated plants, including elm and apple trees and potato. The eggs are laid in September deep in tender branches, especially of young apple trees, the injury sometimes killing the branch. The larvae hatch the following May and live on low-growing plants, preferably potato.

[VUKASOVIĆ' VOUKASSOVITCH (P.). **Observations biologiques sur un Lépidoptère (*Ephestia kuehniella* Zell.).**—*C.R. Soc. Biol.*, c, no. 1, pp. 62–64. Paris, 11th January 1929.

Among larvae of *Ephestia kühniella*, Zell. (Mediterranean flour moth) that had developed in the same flour, 20 per cent. pupated in cocoons in the middle of the flour, 30 per cent. pupated on the surface without spinning cocoons at all, and 50 per cent. left the flour altogether, pupating either with or without cocoons in sheltered places of various sorts. The sex of the larvae did not apparently influence the manner of pupation, although females predominated among those that left

the flour. The pupal stage lasted 12–13 days at 23° C. [73·4° F.], and 7–10 days at 28° C. [82·4° F.]. The adults generally emerge at night and move very little during the day ; when they are disturbed, they fly rapidly in zig-zags towards the light. Mating takes place at night, and has been observed at temperatures of 14° C. [57·2° F.] and 24° C. [75·2° F.] ; females seldom mate more than once. At 17° C. [62·6° F.] the first oviposition took place almost immediately after mating, and more eggs were laid then than at any subsequent oviposition. The average number of eggs laid by one female appears to be about 320. The eggs were usually laid singly or in groups of 2–3, though occasionally groups of 20 or 50 were observed. The oviposition period normally lasts 5–7 days, but heat accelerates the deposition of the eggs, which usually ceases altogether when the temperature falls below – 5° C. [23° F.].

[Vukasović] Voukassovitch (P.). **Nouvelles observations sur** *Ephestia kuehniella* **Zell.**—*C.R. Soc. Biol.*, c, no. 1, pp. 64–67. Paris, 11th January 1929.

Further experiments with *Ephestia kühniella*, Zell., showed that the length of the egg stage varies from 4 to 14 days, according to the temperature. Larvae exhibit negative heliotropism until they are about to pupate. Notes are given on oviposition by unfertilised females, which lived for 8–24 days. Larvae confined in an entirely dry environment pupated normally, 80 per cent. of them spinning cocoons ; adults emerged and the eggs laid hatched in the usual period. Larvae kept in a very damp environment also pupated in the normal length of time, but all spun cocoons and only 60 per cent. emerged as adults after a delay of 8 to 10 days. The average number of eggs laid by the females kept in the dry atmosphere was 225, and in the damp, 171. Females exposed constantly to electric light oviposited some hours after the normal period, laying an average of 198 eggs. The average number of eggs laid by females exposed to very weak artificial light during the night, and to normal light during the day, was 206, the majority being laid during the day. An average of only 132 eggs was laid by moths kept entirely in the dark.

Paillot (A.). **Pathogénie de la muscardine du ver à soie.**—*C.R. Soc. Biol.*, c, no. 5, pp. 353–354. Paris, 8th February 1929.

The method of penetration of the fungus, *Beauveria bassiana*, causing muscardine disease, into the body of the silkworm [*Bombyx mori*, L.] is described, the observations being made after spraying the larvae with an emulsion of the conidia of the fungus.

Reh (L.) & others. Sorauer : **Handbuch der Pflanzenkrankheiten. Bd. V. (Tierische Schädlingen an Nutzpflanzen. II. Teil) Erste Hälfte (Bogen 1-26).** [Sorauer. Text-book of Plant Diseases. Vol. V. (Animal Pests of Economic Plants. Part 2) 1st Half.]—Roy. 8vo, pp. 1–416, 185 figs. Berlin, P. Parey, 1928. Price *M.* 28.

This is the first half of the second part of the much enlarged fourth edition of Sorauer's text-book [*cf. R.A.E.*, A, xiii, 163], and deals with the Diptera, Coleoptera, and part of the Hymenoptera.

Ferwerda (F. P.). **Genetische Studien am Mehlkäfer** *Tenebrio molitor* **L.** [Genetic Studies on the Flour Beetle.]—*Genetica*, xi, reprint 110 pp., 1 pl., 24 figs., 80 refs. The Hague, M. Nijhoff, 1928. Price 5 *Gld.*

These studies are in continuation of work done by S. A. Arendsen Hein [*R.A.E.*, A, xi, 364], and describe the results of crossing examples of *Tenebrio molitor*, L., that differ in various characters.

Groom (P.). **Antiseptic Preservation of Timber.**—*Emp. Forestry J.*, vii, no. 2, pp. 225–251. London, 1928.

This paper deals with the preservation of timber from attack by fungi that cause rot, and only incidentally with insects which carry spores accidentally or introduce into their tunnels definite species of symbiotic fungi that grow on the wood and are used as food by the insects. Various preservatives are discussed, and methods for testing and applying them are described.

Speyer (E. R.). **The Greenhouse Whitefly** (*Trialeurodes vaporariorum* **Westwood**).—*J. R. Hort. Soc.*, liv, pt. 1, pp. 181–192, 9 pls., 9 refs. London, January 1929.

Trialeurodes vaporariorum, Westw. (greenhouse whitefly) was so numerous in the Wye Valley some years ago that it is estimated to have caused losses amounting to £30,000 annually in that district alone, before the fumigation of greenhouses against it was begun. With the present methods of combating the whitefly such losses are unknown, but it is still impossible to eradicate it, and the presence of black moulds consequent upon infestation is very deleterious to plants and necessitates the wiping of tomato fruit before it can be marketed. The life-history and habits of *T. vaporariorum* are described in detail, and the latest methods of fumigation with hydrocyanic acid gas [*R.A.E.*, A, xiv, 188] and tetrachlorethane are discussed. The Chalcid parasite, *Encarsia formosa*, Gahan [xv, 240], which exerts complete control of this Aleurodid in Bermuda and has also been recorded in the United States, occurs in England and is being successfully bred in glasshouses during the winter (as it cannot survive out of doors) for distribution. Some 140,000 parasites have been reared and distributed in England and abroad during a period of five months. The foliage of some plants, especially tobacco, *Bouvardia*, *Datura*, *Abutilon* and *Eucalyptus*, are repellent to the parasite; it is chiefly by the medium of infested tomato leaves that it is distributed. The spring is the best time for this; if distribution is later than July, the parasite cannot immediately cope with a severe infestation, especially as the egg-laying capacity of the females seems to diminish at the end of September.

Wilson (G. F.). **The Rhododendron White Fly.** *J. R. Hort. Soc.*, liv, pt. 1, pp. 214–217, 3 figs. London, January 1929.

Further notes are given on the whitefly, *Dialeurodes chittendeni*, Laing, found infesting rhododendrons in Surrey, Berkshire and Hants [*R.A.E.*, A, xvi, 620]. Only smooth-leaved varieties and hybrids are chosen as food-plants, *Rhododendron ponticum* being especially susceptible. The stages are briefly described. Adults are found chiefly from the

end of June to mid-July, when they are generally resting on the younger leaves, where the females begin to oviposit. The eggs are laid singly and hatch in from 8 to 15 days, the larvae, after the first moult, settling down to feed on the lower surface of the leaves. There was only one generation in the year of the investigation, but the presence of pupae on foliage in mid-September suggests the possibility of a second. Growers of rhododendrons are urged to keep watch for this pest and to pick off and destroy any infested leaves. In infested plantations and shrubberies the best remedy is to spray the lower surface of the leaves with a highly refined emulsified oil, used at 2 per cent. strength, and applied at a pressure of at least 90 lb. to the square inch. Washes containing nicotine and derris were less toxic to the immature stages of the insect.

FAES (H.). **Un contre-parasite du puceron lanigère, l'***Aphelinus mali*.—*Annu. agric. Suisse*, xxix, pt. 5, pp. 515–519, 2 figs. .Berne, 1928.

An account is given of the introduction and establishment of *Aphelinus mali*, Hald., against *Eriosoma lanigerum*, Hausm., in Switzerland. There are 6 or 7 generations of *A. mali* a year in that country ; only one egg is laid in each host, as many as 60 being deposited by a single female. In summer the eggs hatch in 3 or 4 days, the larval stage lasts 10–12 days, and the pupal about a week. Hibernation takes place in the larval or pupal stage in the body of the host. The methods adopted for the establishment of the colonies of *A. mali* are described.

FAES (H.). **La lutte contre les chenilles fileuses ou chenilles d'Hyponomeutes.**—*Annu. agric. Suisse*, xxix, pt. 5, pp. 520–533, 11 figs., 4 refs. Berne, 1928.

A detailed account is given of the biology of *Hyponomeuta malinellus*, Zell., on apple, as observed in Lausanne during the seasons 1926–28. Eggs deposited on 11th July hatched on the 25th, but the larvae remain under the protective covering of the closely packed eggs until the following spring, when they perforate the covering and spread to the young leaves. It was found, contrary to previous records, that the egg-masses are not surrounded by a common protective envelope, but that each egg has its own covering, which is in contact with the adjacent ones. The larvae emerge in April and mine in the leaves, working in groups and leaving the upper and lower epidermis intact. After feeding for 10 or 12 days, they emerge from the leaves and construct the silken nest inside which they continue their life and in which they pupate in late June or early July, the moths emerging about a fortnight later. The larvae can be destroyed by using metal gloves and crushing them, or by detaching and burning the nests ; in either case some larvae escape by lowering themselves on threads and afterwards regain the tree. Good results have been obtained by using a spray of 6 lb. soft soap and 1 lb. liver of sulphur in 20 gals. water, which penetrates and destroys the nests. Another solution is made by dissolving 2 lb. caustic soda in 3 gals. water, adding 15 lb. pine resin and heating the mixture until all is dissolved. An equal quantity of water is added, and the whole is filtered through a cloth ; 1 gal. ammonia (0·920) is

then added, with water to bring up to 100 gals. This can also be prepared without heating by adding 1 gal. methylated spirit to dissolve the pine resin and the caustic soda.

As the usual winter treatments practised in orchards had given very little protection against *H. malinellus*, it was decided to attack the young larvae while still under the shelter of the eggs where the usual winter sprays did not penetrate. Several substances were tried without effect. The only one that gave complete satisfaction is prepared by dissolving ½ lb. soft soap in 1 gal. hot water, and adding, while still hot, 5 pints kerosene, agitating it to an emulsion. This is poured into a solution of 2 lb. caustic soda (NaOH 98 per cent.) dissolved in 9 gals. soft water, and the whole well mixed. This mixture is able to penetrate the egg coverings and kill all the young larvae. Its efficacy may be still further increased by adding 15 per cent. nicotine, 1 : 100. No injury to the trees followed the use of this emulsion.

If the larvae of *H. malinellus* have already emerged, they must be dealt with by the usual spring arsenical treatments.

Baudyš (E.). **Fytopathologické poznámky iv.** [Phytopathological Notes, iv.]—*Ochrana Rostlin*, viii, pt. 6, pp. 151–162, 10 figs. Prague, December 1928. (With a Summary in German.)

This is a short account of observations on various plant diseases and pests in Czechoslovakia in 1928. *Caliroa annulipes*, Klug, skeletonised the leaves of willows and lime trees; *C. cinxia*, Klug, infested oaks; and *C. limacina*, Retz., was abundant on various fruit trees, as well as on oaks and willows. The larvae of *Priophorus padi*, L. (*Cladius albipes*, Fall.), and *Eriogaster lanestris*, L., seriously infested fruit trees, the latter chiefly attacking cherries. Lucerne was damaged by *Subcoccinella vigintiquatuorpunctata*, L. (*Epilachna globosa*, Schneid.), and the leaves of clover were skeletonised by various species of *Apion*, the development of the pods being retarded and the crop of seeds greatly reduced. Clover from the infested fields should be used as food for cattle immediately after the seeds are harvested, as the larvae of some species live in the stems and buds of the plant and may spread if the clover is stored. Blackcurrant and gooseberry bushes were completely defoliated by the larvae of *Pteronus* (*Pteronidea*) *ribesii*, Scop. (*ventricosus*, Latr.), causing the fruit to fall before it ripened. Sprays of salt and water or of barium chloride (1 oz. to 3½ pints water with a small quantity of flour) are recommended. The soil under the bushes should be dug up in autumn and poultry allowed to feed on the pupae of this sawfly. *Caliroa aethiops*, F., *Arge* (*Hylotoma*) *rosae*, L., and *Blennocampa pusilla*, Klug, infested roses.

Kleine (R.). **Weitere Bekämpfungsversuche gegen** *Grapholitha dorsana*. [Further Experiments in combating *Cydia dorsana*.]—*Fortschr. Landw.*, iv, no. 2, pp. 45–46. Vienna, 15th January 1929.

Previous investigations have shown that an increase of water-content exposes mature peas to attack by *Cydia* (*Grapholitha*) *dorsana*, L. [*R.A.E.*, A, xi, 158]. The sea-fogs on the coast of Pomerania are a factor, as well as rain, in causing the peas to swell. Dry seeds can attract moisture to such a degree as to invite attack, and the short period elapsing before they become dry again suffices for the complete

development of the larvae of *C. dorsana*. In experiments, stacking in various ways peas that were mown in early August and left in the field until early September did not prevent their becoming liable to infestation, as the plants lie too loosely to prevent rain from entering the stack whatever the method of piling them.

[**Control of Insect Pests in Denmark.**] —*Medd. Statens Forsøgsvirks. i Plantekultur, Lyngby*, nos. 76, 83, 84, 122, 145, 146 & 150. Copenhagen, February 1928–January 1929.

Insects dealt with in these leaflets, the majority of which are revisions of previous publications, include : *Trioza viridula*, Zett., *Phyllotreta nemorum*, L., *Phorbia brassicae*, Bch., *Tipula paludosa*, Mg., *Incurvaria capitella*, Cl., *Bryobia ribis*, Thomas, and *Lygus pabulinus*, L. An account is given (in nos. 122, 146 and 150) of the sprays at present in use against the insect pests of orchards and bush-fruits and the methods of preparing them, with indications as to the method and time of application.

ØHLERS (H.). **Forsøg med Rygning med forskellige Nicotin-Midler i Vaeksthuse.** [Fumigation Experiments in Glasshouses with various Nicotine Preparations.]—*Gartner-Tidende*, 1928, reprint 12 pp., 1 fig. Copenhagen, 1928.

An account is given of a number of experiments in greenhouse fumigation in which 14 different nicotine preparations in liquid, strip and powder form were used against Aphids, whiteflies, thrips, Coccids and mites. Various types of lamps employed are described, and the comparative merits of the fumigants, the majority of which are proprietary, are shown in tables, which also give details of the quantity of fumigant to be used in each case in relation to the cubic space of the greenhouse. The most successful results were obtained against Aphids, fumigation at regular intervals of 10–14 days being necessary to combat a severe attack. The susceptibility of certain plants to nicotine fumigation is also discussed.

GRAM (E.), JØRGENSEN (C. A.) & ROSTRUP (S.). **Oversigt over Sygdomme hos Landbrugets og Havebrukets Kulturplanter i 1927.** [Report on Plant Diseases and Pests in Denmark in 1927.]—*Tidsskr. Planteavl*, xxxiv, pp. 778–839. Copenhagen, 1928.

Pests occurring in Denmark in 1927 and not already dealt with in previous reports [*R.A.E.*, A, xii, 508 ; xiii, 536 ; xv, 274 ; xvi, 217] include : *Haplothrips aculeatus*, F., *Zabrus tenebrioides*, Goeze (*gibbus*, F.), *Calandra granaria*, L., *Trachea* (*Hadena*) *secalis*, L., *Contarinia tritici*, Kirby, and *Sitodiplosis mosellana*, Géh. (*aurantiaca*, Wagn.), *Elachiptera cornuta*, Fall., *Tarsonemus spirifex*, Marchal, and *Pediculopsis* (*Pediculoides*) *graminum*, Reut., on cereals ; *Aphis fabae*, Scop., on leguminous plants and beet ; the millepede, *Blaniulus guttulatus*, Gerv., on peas ; *Atomaria linearis*, Steph., *Polia* (*Mamestra*) *oleracea*, L., and *Meligethes aeneus*, F., on sugar-beet ; and *Phorbia* (*Chortophila*) *brassicae*, Bch., on crucifers. Pests of pome fruits included *Hyponomeuta malinellus*, Zell., on apple, *Hoplocampa brevis*, Klug, and *Dasyneura* (*Contarinia*) *pyri*, Bch., on pears, and *Phyllobius oblongus*, L., *Enarmonia* (*Grapholitha*) *woeberiana*, Schiff., and *Malacosoma*

(*Gastropacha*) *neustria*, L. Among pests of stone fruit, *Hoplocampa fulvicornis*, Panz., occurred on plums and *Phalera bucephala*, L., on cherries. Raspberries were attacked by *Anthonomus rubi*, Hbst., red currants by *Incurvaria capitella*, Cl., black currants by *Eriophyes ribis*, Nal. ; and strawberries by *Oxygrapha* (*Acalla*) *comariana*, Zell., and *Tarsonemus fragariae*, Zimm.

[Predtechenskiĭ (S. A.).] **Предтеченский (С. А.). The Acrididae of the Lower Volga Region.** [*In Russian.*]—*Comment. Inst. astrachan. Defens. Plant.*, ii, pt. 1, 115 pp., 42 refs. Astrakhan, 1928. (With a Summary in English.)

A very detailed account is given of the Acrididae of the Lower Volga region, with a list of species, and data on their distribution, ecology, phenology, etc. The species of economic importance dealt with are *Locusta migratoria*, L., and *Calliptamus italicus*, L.

A special chapter deals with the influence of spring floods on the eggs of Acrididae, and the conclusion is reached that this may be one of the factors controlling the numbers of *Locusta migratoria* in the region. Observations have shown that submergence is injurious to the eggs when the embryos in them are in a rather advanced state of development, though earlier submergence often has no effect on them.

A list of natural enemies of Acrididae is given, including *Blaesoxipha lineata*, Fall., *B. filipjevi*, Rohd., *B. grylloctona*, Lw., *Acridomyia sacharovi*, Stackel., *Sphex subfuscatus*, Dahlb., and *Scelio* sp., all attacking *Locusta migratoria*, and *Asilus gigas*, Ev., attacking *Calliptamus italicus*.

[Moritz (L.).] **Мориц (Л). Results of a Survey of the Acrididae in Northern Persia in 1927 and 1928.** [*In Russian.*]—8vo, 52 pp., 13 figs., 6 refs. Ashkhabad, Narkomz. Turkm. S.S.R. Stazra, 1928. Gratis.

By an agreement between the Persian and Russian governments, locust control work has been organised by Russian specialists in the Khorasan province of Persia during 1927 and 1928. The locust that invaded Persia proved to be *Schistocerca gregaria*, Forsk., while some work was also done against *Calliptamus italicus*, L. The object was merely to demonstrate the possibility of controlling locusts by poisoned baits, which gave very good results, the northern parts of Persia being cleared of locusts, though the south remained heavily infested.

The swarms of *S. gregraria*, which came from India and southern Afghanistan, invaded a vast area [*R.A.E.*, A, xvii, 137], and the eggs laid by them hatched in May–June. New flying swarms moved mainly in an easterly and north-easterly direction, and many of them apparently penetrated into Afghanistan.

The locusts that invaded Khorasan belonged to the swarming phase, and breeding experiments under normal and crowded conditions confirmed the results obtained in similar experiments by Johnston [*R.A.E.*, A, xiv, 571]. The locusts of the next generation proved to belong to a form transitional to the solitary phase (*flaviventris*, Burm.), but they exhibited typically swarming habits. A bacterial epidemic was

observed amongst the locusts bred in cages. Descriptions of all the immature stages are given, and a list of the ACRIDIDAE collected during the work in Persia is appended.

Of other pests observed in Persia the more important were *Epilachna chrysomelina*, F., on melons, *Euxoa segetum*, Schiff., *Cydia pomonella*, L., *Pieris brassicae*, L., and *Tetranychus telarius*, L.

It is suggested that mixed commissions representing Russia, Persia and Afghanistan should be formed in order to regularise the problem of the control of pests that are important in all these countries.

[FEDOROV (S. M.).] **Федоров (С. М.).** *Leucaspis pusilla*, **Löw. Data on its Distribution, Biology, economic Importance and possible Control.** [*In Russian.*]—*Zap. gosud. Nikitsk. opuitn. bot. Sada*, xi, no. 1, reprint 23 pp., 10 figs., 13 refs. Yalta, 1929.

Leucaspis pusilla, Lw., is an important pest of pines on the southern coast of the Crimea. In the summers of 1927 and 1928 over 15 species of pines were found to be heavily infested, of which *Pinus laricio* var. *pallasiana* and *P. strobus*, suffer the most ; *P. halepensis* var. *pityusa* is only very slightly attacked. The adults and larvae of both sexes of this Coccid are described, and a key is given to allied species of *Leucaspis* that are likely to occur in the Crimea with notes on their geographical distribution.

L. pusilla has two generations a year in the southern Crimea. The males of the first generation are on the wing in the second half of May, and the females continue to produce young until the middle of the summer. The second generation reaches maturity in August, and the females produce young that begin to develop in autumn. The females hibernate in the larval stage, and the males as pupae, on the inner side of the needles of the tree. *L. pusilla* occurs almost exclusively on the needles of pines and only very seldom on the cones. In the course of the summer the larvae gradually migrate from old needles to young ones ; this process is discussed in detail. Infestation is usually spread artificially, but infested twigs or needles may be carried considerable distances by wind, and first instar larvae may migrate from one tree to another. At present about 70 to 80 per cent. of the pines in forests and parks of the region under review are infested, and as result a great number of trees degenerate and die out.

Natural enemies of *L. pusilla* include a Pteromalid parasite and a mite, as well as the Coccinellid, *Chilocorus bipustulatus*, L., which occurs in large numbers on pine trees. In parks satisfactory results have been obtained with sprays of nicotine or soap (1 lb. to 4 gals. water) or with oil emulsion containing 2 gals. kerosene, 1 gal. water and 1 lb. soap, diluted 1 : 20. In forests trees other than pines should be planted round the infested areas as screens to prevent migration. The urgency of this measure is emphasised. Attention should be devoted to methods of disinfecting seedlings and to the possibility of fostering the natural enemies of *Leucaspis*. In an experiment young pines were successfully fumigated under a tent, at a temperature of 18° C. [64·4° F.] and an exposure of 30 minutes, with potassium cyanide at the rate of about $\frac{1}{4}$ oz. to 100 cu. ft. In this case the trees were not injured, but this fumigant should not be used when the trees are damp or when the temperature exceeds 20° C. [68° F.].

[Fedorov (S. M.).] **Федоров (С. М.). The Pests and Diseases of Vines and Tobacco and their economic Importance.** [*In Russian.*]—*Zap. Yaltinsk. Muz. Kraeved.*, 1928, no. 2, reprint 11 pp., 9 refs. Yalta, 1928.

[Fedorov (S. M.).] **Федоров (С. М.). Calendars for the Control of the chief Pests and Diseases of Vines and of Tobacco in the Crimea.** [*In Russian.*]—[*Byull.*] *Stantz. Zashch. Rast. Yuzhn. Ber. Kruima* [*Bull. Sta. Protect. Plants S. Coast Crimea*], no. 1, 24 pp., 19 figs., 12 refs ; no. 2, 19 pp., 10 figs., 15 refs. Yalta, 1927 & 1928.

These are popular papers on the pests and diseases of tobacco and vines in southern Crimea and their control. The insects attacking tobacco are *Gryllotalpa gryllotalpa*, L., *Euxoa* (*Agrotis*) *obesa*, Boisd., *Opatrum sabulosum*, L., and *Thrips tabaci*, Lind. Those attacking vines include *Clysia ambiguella*, Hb., as well as a number of pests that have already been recorded [*R.A.E.*, A, xv, 342 ; xvi, 547].

[Shchegolev (V.).] **Щеголев (В.). The Pests of Sunflower and Safflower and the Damage done by them.** [*In Russian.*] —*Maslob.-Zhirov. Delo*, no. 11 (40), pp. 33–44, 22 figs., 13 refs. Moscow, 1928.

This is a list of 68 injurious insects recorded in Russia as infesting sunflowers (*Helianthus annuus*) and safflowers (*Carthamus tinctorius*), showing the parts of the plants attacked and the stage in which each pest causes damage. A key is given for the determination of the pests in the stage in which they attack the plants, based on their morphological characters and on the injury caused.

[Shchegolev (V.).] **Щеголев (В.). Pests of oil-producing Plants in the Northern Caucasus.** [*In Russian.*]—*Maslob.-Zhirov. Delo*, no. 9(38), pp. 32–37, 3 figs., 4 refs. Moscow, September 1928.

Heliothis dipsacea, L., is a very serious pest of oil-producing plants in the Northern Caucasus, and a special study of it was organised in 1927 and 1928. Although the larvae are general feeders and have been observed on at least 70 different plants, they prefer flax. In the first three instars, they feed on the buds and flowers, but subsequently they infest the bolls and destroy the seeds. Next to flax, soy beans (*Glycine hispida*) are preferred. Oviposition occurs on the young upper leaves, and the larvae feed on them and also attack the flowers and pods, in which they destroy the half-ripe beans. Usually the larvae of the first generation feed exclusively on the leaves, whereas those of the second generation, which occur from July to the first half of September, attack the beans. In the summer of 1928 70 per cent. of the soy beans in some districts were infested by the first generation ; the damage caused by the larvae of the second was considerably less, owing to a partial sterility of the females as a result of bad nutrition. Several other oil-producing plants were slightly damaged by *H. dipsacea*, including *Ricinus communis*, *Nigella sativa*, *Perilla ocimoides*, hemp (*Cannabis sativa*), ground-nuts (*Arachis hypogaea*), *Guizotia oleifera*, *G. abyssinica*, *Carthamus tinctorius* and *C. lanatus*. The larvae of the second generation usually attack the leaves of *Helianthus annuus*, but in 1928 they attacked the seeds, considerably reducing the crop

Mordvilko (A. K.). *Geoica* **Hart, and its anholocyclic Forms.**—*C. R. Acad. Sci. U.R.S.S.*, 1928, no. 25, pp. 525–528, 9 refs. Leningrad, 1928.

This is a paper supplementary to one already noticed [*R.A.E.*, A, xv, 652]. The author describes the characters of his genus *Pemphigetum* [xvii, 10], which includes *P. utricularium*, Pass., and *P. muticae*, Mordv. From the characters of certain forms of Aphids found on grass roots (*Geoica*) and on *Pistacia* in various localities, he concludes that the former are exules or anholocyclic forms of *Pemphigetum*, which thus sinks as a synonym of *Geoica*.

In southern Europe and Western Asia, where *Pistacia terebinthus* and *P. mutica* grow, colonies of *Geoica* on grass roots will belong mainly to the cycle of generations of gall forms. In northern Europe, Siberia and North America, anholocyclic forms are found. Provisionally the author calls all these anholocyclic forms *G. utricularia*. *G. utricularia* has been found on wheat roots near Omsk, Siberia, and it also occurs in North America, where it has been known under the name of *G. squamosa*, Hart. The author considers that these anholocyclic forms arose when *Pistacia* disappeared, and in this connection he discusses the distribution of *P. mutica* and *P. terebinthus* in the tertiary period, as indicated by the survival of anholocyclic forms of other Aphids.

Geoica lucifuga, Zhnt., which infests the roots of sugar-cane in Java and Formosa and has also been found in Poland and Bokhara, is possibly connected with *Pistacia chinensis*, which probably grew in Europe during the tertiary period.

Osman (A.). **Lutte contre les ennemis du tabac. Les vers gris.**—*Rev. tech. Monopole des Tabacs*, i, no. 2, pp. 47–55, 7 refs. Galata, Constantinople, April 1928.

A general account is given of the cutworms infesting tobacco. The most important occurring in Turkey are *Euxoa* (*Agrotis*) *segetum*, Schiff., *A. pronuba*, L., *A. comes*, Treit., *Feltia* (*A.*) *exclamationis*, L., *A. ypsilon*, Rott., *E.* (*A.*) *tritici*, L., and *E.* (*A.*) *annexa*, Treit. Notes are given on the first four of these, and the usual methods of control, including hand-picking, protective disks, baits, spraying the plants with barium chloride, autumn cultivation, trenches to stop migration, and destruction of the adults, are reviewed.

Krishnamurthy (B.). **Aphididae of Mysore.**—*J. Bombay Nat. Hist. Soc.*, xxxiii, no. 1, pp. 211–215. Bombay, 30th September 1928.

The Aphids dealt with are *Pentalonia nigronervosa*, Coq., on banana (*Musa sapientium*); *Therioaphis ononidis*, Kalt., on lucerne; *Aphis gossypii*, Glov., which is sometimes a minor pest of cotton and brinjal (*Solanum melongena*), and occurs on various other cultivated plants; *A. maidis*, Fitch, on ragi (*Eleusine coracana*); *A. rumicis*, L., on cowpea (*Vigna catjang*); *A. laburni*, Kalt. (*medicaginis*, Koch), on *Dolichos lablab* and *Crotalaria*; *A. tavaresi*, Del G., on *Citrus*, especially limes and oranges; *A. nerii*, Boy., on *Calotropis gigantea*; *A.* (*Longiunguis*) *sacchari*, Zehnt., on *Sorghum vulgare*; *A.* (*Rhopalosiphum*) *pseudobrassicae*, Davis (*Siphocoryne indobrassicae*, Das), on mustard (*Brassica nigra*); *Toxoptera aurantii*, Boy., on *Albizzia odoratissima*; and *Myzus persicae*, Sulz., on tobacco and cabbage. Notes are given on the morphology and colouring of the first six species.

SAITO (K.). **The Insect Pests of** *Pinus densiflora* **in Korea.** [*In Japanese.*]—*J. Chosen Nat. Hist. Soc.*, no. 7, pp. 10–13. Keijo, Korea, December 1928.

A list is given of 33 species of insects injurious to *Pinus densiflora* in Korea, with brief notes on their life-history. *Dendrolimus spectabilis*, Butl., and various Lamellicorn larvae are the most important, the latter causing serious damage in nurseries.

KOBAYASHI (G.). **On** *Bemisia myricae* **Kuwana, a Pest of Mulberry.** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 1, pp. 9–13. Gifu, January 1929.

The Aleurodid, *Bemisia myricae*, Kuw., is common in the Wakayama prefecture, sometimes causing serious damage to mulberry in summer. It also attacks *Myrica rubra*, *Citrus*, *Salix*, tea, *Prunus* spp., *Cinnamomum camphora*, etc. There appear to be 6 or 7 generations a year, hibernation taking place in the larval stage on green leaves, and almost all the stages can be seen from spring to autumn. The adults appear first in the middle of May on the young buds. They become active when the temperature exceeds 15° C. [59° F.] and oviposit mostly on unfolding leaves 2 or 3 days after emergence. The eggs hatch in about a week, and the larval stage lasts about 15 days; the pupal stage lasts 5 days in spring.

MATSUDA (M.). **Observations on** *Chrysopa septempunctata* **Wesm. subsp.** *cognata* **McLach.** [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xli, no. 484, pp. 49–77. Tokyo, February 1929.

An account is given of detailed observations on the bionomics of *Chrysopa septempunctata*, Wesm., subsp. *cognata*, McLach., which is an important enemy of *Hyalopterus arundinis*, F., on peach in Nara and Kyoto, one individual destroying as many as 900 Aphids.

BULIGAN (C. T.). **The Corn Borer,** *Pyrausta nubilalis* **Hübner (Pyralidae, Pyraustinae, Lepidoptera).**—*Philipp. Agric.*, xvii, no. 8, pp. 397–450, 8 pls., 9 pp. refs. Los Baños, Laguna, January 1929.

Pyrausta nubilalis, Hb. (European corn borer) is one of the most serious pests of maize in the Philippines, over 50 per cent. of the crop being destroyed in some localities. Its synonymy and distribution are discussed, the literature is briefly reviewed and all stages are described in detail. Life-history studies were carried out in the Philippines from October 1924 till December 1926, and parasites and predators were collected. *P. nubilalis* occurs at all seasons, usually infesting maize at any time after tasselling. Maize and sorghum were the only plants observed to be attacked, the borer showing a distinct preference for maize, both local varieties of which seem to be equally susceptible. Whereas the infestation of the crop over the whole period of observation varied from 2 to 90 per cent., the rate of infestation from May to September both in 1925 and 1926 varied from 50 to 98 per cent., the greater intensity of infestation usually occurring when the area planted with maize was small.

All stages of the borer occur concurrently in heavily infested fields. The eggs are laid in masses of from 6 to 130 on the lower surface of the leaves, and the larvae feed on the epidermis of the leaves, subsequently boring

in the midribs and tender portions of the stalks and ears of the same or other maize plants. The tunnels extend into the lower part of the stalk to within 2 inches of the ground. Each tunnel usually contained one larva, but as many as 16 larvae of different ages were found in the stalk of a severely infested plant. The life-cycle lasts from 32 to 53 days, the minimum occurring during the latter part of the dry season when the maximum temperature was 33° C. [91·4° F.], and the maximum in the rainy season when the temperature was low. Whereas in America and Europe *P. nubilalis* has only one or at most two generations, in the Philippines it goes through at least nine generations during the year. The egg, larval and pupal stages last 4–5, 18–41, and 5–12 days, respectively, and there are six larval instars. The moths live for 2–19 days, the female laying an average of 465 eggs and beginning to oviposit 1–3 days after emergence.

Among the natural enemies observed during these studies were 9 Hymenopterous parasites, including the Braconid, *Chelonus communis*, Baker (MS.), and the Ichneumonid, *Xanthopimpla stemmator*, Thnbg., which attacked the larvae, and *Brachymeria* (*Chalcis*) *euploeae*, Hope, which attacked the pupae. The Reduviid, *Phemius tibialis*, Westw., and the Chesilochid, *Proreus simulans*, Stål, were predacious on the larvae; and the Reduviid, *Sphodronyttus erythropterus*, Burm., and the Histerid, *Carpophilus foveicollis*, Murr., attacked both larvae and pupae. A list of the known parasites occurring in America and Europe is given. General recommendations for control include attempted starvation of the borer by preventing it from getting access to suitable food at certain periods of the year. For this purpose crops should be cultivated in rotation, and maize, sorghum and millet should be planted at approximately the same time in a given locality. Wild grasses (*Panicum* spp.) should be eliminated from the field and vicinity so far as possible by thorough cultivation. Millet and *Panicum* have previously been recorded as food-plants of *P. nubilalis* in the Philippines, but were not found to be infested during the present work.

François (E.). **Sur un nouvel ennemi de la vanille** (*Perissodores oblongus* **Hust.**).—*Rev. Bot. appl.*, viii, no. 85, pp. 617–620, 1 ref. Paris, September 1928.

François (E.). **Note complémentaire sur un nouvel ennemi de la vanille.**—*Rev. Bot. appl.*, viii, no. 88, pp. 859–860. Paris, December 1928.

In 1926 *Perissodores oblongus*, Hust., was found injuring vanilla plants in the coastal province of Vatomandry, Madagascar. Descriptions of the genus and species are quoted. The adults are numerous from October to December, attacking the lower surface of the leaves. The eggs are deposited in the stem at one of the lower nodes. The larvae mine in the stems, developing rapidly and spinning cocoons in the mines. All stages are found throughout the year, but the earlier stages are more abundant during the first half, and the cocoons and adults during the second half.

The injury is at present of little importance, and the attacks are localised. No signs of infestation by this weevil have yet been found in the region of Antalaha and the Comoro Islands, from which localities almost all exported vanilla is obtained. Damaged vines should be burned, the transport of green pods and cuttings from infested areas

should be forbidden, and the adults should be collected by hand at the time the flowers are fertilised (October-November). Attempts should be made to find and destroy any alternative food-plants.

Vines damaged by *P. oblongus* were found to contain numerous colonies of a fungus of the genus *Gloeosporium*, and since this is only abundant on vanilla in plantations where the weevil is numerous, it is undoubtedly associated with it, a fact that confirms the necessity for controlling the insect.

Michel (E.). **Les vers à soie sauvages du Congo belge.**—41 pp., 18 figs., 21 refs. Brussels, Imprimerie industrielle et financière, 1928. Price *Fr.* 10.

This account of the wild silkworms of the Belgian Congo is preceded by an introductory review of the biology and commercial importance of *Bombyx mori*, L. The species of wild silkworms known in the Belgian Congo are *Anaphe infracta*, Wals., *A. venata*, Butl., and *A.* (*Epanaphe*) *moloneyi*, Druce, which are by far the most numerous, *A. leplaei*, Mayné, and *A.* (*E.*) *carteri*, Wals., which are also numerous, and in far fewer numbers, *A. panda*, Boisd., *A. reticulata*, Wlk., *A. maynei*, Hulst., *A.* (*E.*) *salana*, Strand, *A.* (*E.*). *candezoi*, Hulst., *A.* (*E.*) *nigripicta*, Hulst., and *A.* (*E.*) *unifascia*, Hulst. They have a variety of food-plants, the distribution of some of which in the Belgian Congo is indicated, but *Bridelia* spp., particularly *B. micrantha*, are preferred by *A. infracta*, *Albizzia* and *Sterculia* by *A. venata*, and *Albizzia* by *A. moloneyi*. The possibilities of the semi-domestication of *Anaphe* spp. are discussed, and the method of rearing is explained. A suitable site should be chosen (near a railway or waterway) and the area planted with *B. micrantha*, which is easy to grow and adaptable to various kinds of soil. To prevent the migration of larvae, a trench might be dug round the planted area and filled with water, at least during the larval period. In other respects, the rearing is quite free and in the open air. The method of preparing the nests of the three most abundant species for shipment is explained.

Myers (J. G.). **Report on Insect Infestation of dried Fruit.**—*E.M.B.* 12, 36 pp. London, H.M. Stationery Office, November 1928. Price 1*s.*

This paper deals almost entirely with dried grapes, because the packing of cut fruits other than pears had been completed before the present enquiry in Australia began. The following is largely taken from the author's summary.

By far the most important pest of Australian dried grapes is *Plodia interpunctella*, Hb., which lives on a variety of dried food products, is nearly cosmopolitan in distribution, and is now essentially an indoor insect. Its life-cycle, which is influenced chiefly by temperature, may vary in Australia from 31 days in the hottest part of the summer to many months if winter intervenes, there being probably two broods a year, which are greatly obscured by individual variation in development [*cf. R.A.E.*, A, xvii, 239]. Fruit shipped in late autumn or winter and encountering hot weather in the tropics will arrive in London in as infested a state as that stored in Australia till the end of January. *Ephestia cautella*, Wlk., is common in the raisin districts, but is attracted chiefly to unpacked fruit, and is therefore largely eliminated by the

grader, re-infestation of packed fruit apparently not taking place. A small Cucujid, *Silvanus surinamensis*, L., is, next to *P. interpunctella*, the most abundant insect in Australian dried grapes, and it attacks fruit that has been previously infested by *Plodia* and *Ephestia* or has been stored a long time. Descriptions of these insects are given with notes on their life-histories.

So long as the present regulations for the cleanliness and control of growers' premises and packing-sheds are enforced, drying-rack infestation by *P. interpunctella* is commercially negligible [*cf. R.A.E.*, A, xv, 25], most of the infestation occurring after the fruit is packed. It is strongly recommended that packing-sheds be thoroughly cleared and disinfected before the first cut fruits begin to arrive, and that the cut fruits themselves be removed and the sheds again cleaned as much before the 31st January (the present regulation date) as conditions in each district will allow. Dried grapes should never be stored with cut fruits of the same season, and until a quicker removal of fruit from growers' premises and sheds can be effected in Western Australia, dried fruit from this State should not be stowed in the same hold or stored in the same warehouse as that from Victoria or South Australia. Storage-sheds should be brought under the same regulations as the packing-sheds.

The ordinary stemming and grading machine was found by experiment to eliminate all stages of *Plodia* and *Ephestia* except about 5 per cent. of the eggs. Ants of the genus *Iridomyrmex*, especially *I. detectus*, Sm., and *I. rufoniger*, Lowne, and the Braconid, *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.), destroy large numbers of the caterpillars of both species. The moths may be trapped by means of cold tea exposed in shallow pans. If sterilisation of the fruit proves necessary before packing, it is most efficiently and economically done by heat. Of fumigants, the cheapest and most efficient known to the author is a proprietary one. Owing to the cost of adequate sampling to ascertain infestation, it will be necessary to continue to fumigate all Australian fruit on arrival in England, at least until insect-proof packing is adopted, the most promising type of which is a complete paper envelope fitting inside the present wooden boxes. Centralisation of packing-sheds and warehouses is strongly advocated.

KING (K. M.). **Insects affecting Field Crops and Gardens in Saskatchewan, 1922-1927.**—*Sci. Agric.*, ix, no. 6, pp. 373–390, 3 figs., 24 refs. Ottawa, Ont., February 1929.

This is a report on insect pests that occurred in Saskatchewan during 1922–1927, those of special economic standing being discussed in some detail. Notes are given on the relative insect hazards to the various crops ; wheat suffers much more severely than any other of the more important field crops. The weather conditions during the period under review and their relation to insect damage are briefly discussed. Estimates of the more obvious damage to field crops caused by the chief pests, with resulting losses, are presented. *Cephus cinctus*, Nort. (wheat-stem sawfly) was the most outstanding pest during the six-year period, the heaviest losses, estimated at £2,468,000, being involved by the outbreak in 1926. Factors affecting the fluctuations of crop losses by this Cephid are discussed. Wireworms caused considerable damage to various field crops [*R.A.E.*, A, xvi, 509, 600].

Of the spring cutworms, *Euxoa tristicula*, Morr., and *Chorizagrotis auxiliaris*, Grt., were of considerable economic importance, whereas the damage caused by *Sidemia devastatrix*, Brace, and *Feltia venerabilis*, Wlk., was insignificant. Other species mentioned are *E. ochrogaster*, Gn. (red-backed cutworm), *E. tessellata*, Harris, and *E. messoria*, Harr. *Porosagrotis orthogonia*, Morr. (pale western cutworm) has spread northward and eastward within recent years from an endemic area in the south-west of the Province. Observations showed that heavy infestation occurred only in fields where the soil crust had been disturbed during the period of moth flight in the previous summer; especially important infestations followed early autumn ploughing. In 1927 about 70 per cent. of the larvae and pupae were killed by parasites, of which the most important were *Gonia brevipulvilli*, Tothill, and *Paniscus* sp. The grasshoppers recorded were *Melanoplus atlantis*, Riley, *Camnula pellucida*, Scud., *M. bivittatus*, Say, *M. femur-rubrum*, DeG., *M. infantilis*, Scud., and *M. packardi*, Scud., but the infestation was not heavy owing to the activity of a variety of parasites and predators, chiefly insects, and to diseases.

Short notes are given on a number of minor pests that were abundant in fields and gardens. It is pointed out that nearly all the major insect pests and most of the minor ones are species native to the original prairie environment that now normally attack cultivated crops. All the other pests have gradually spread in from adjacent areas with the introduction of their food-plants.

HARMAN (S. W.). **The Fruit Tree Leaf Roller in Western New York.** — *Bull. N. Y. Agric. Expt. Sta.*, no. 561, 31 pp., 6 figs., 7 refs. Geneva, N.Y., December 1928.

A brief account is given of the bionomics, distribution and food-plants of *Tortrix* (*Archips*) *argyrospila*, Wlk. (fruit-tree leaf-roller) and the injury caused by it in western New York State, where it is primarily a pest of apples. The results of numerous experiments are discussed, from which it is concluded that oil emulsions containing 8 per cent. actual oil applied thoroughly when the buds are swelling and before any green tissue is showing will destroy the egg-masses, and that the larvae may be controlled by frequent applications of lead arsenate (6 lb. to 100 U.S. gals.) if the growing tips and newly set fruit are kept well covered with the spray during and for a few weeks following the hatching period. Of the oil sprays used, diamond paraffin oil emulsion was the least injurious and cheapest and was at the same time highly efficient. *Zenillia caesar*, Ald., and *Campoplex* sp. were reared from the pupae of *T. argyrospila*.

DANIEL (D. M.). **The Oriental Peach Moth in New York.**—*Circ. N. Y. Agric. Expt. Sta.*, no. 106, 8 pp., 6 figs. Geneva, N.Y., 1928.

Cydia (*Laspeyresia*) *molesta*, Busck, was first found in western New York State in 1926. Notes are given on the injury caused by the larvae to the twigs and fruit of orchard trees, particularly peaches [*cf. R.A.E.*, A, xiii, 384]. The life-history and habits of the moth are briefly discussed; there are at least four generations a year in New York State. No entirely satisfactory method of control has yet been discovered [*cf. R.A.E.*, A, xv, 188]. The author considers that the intro-

duction of parasites is the most promising measure, and since *Macrocentrus ancylivora*, Roh., has been recovered at the places where it was liberated in 1928, the prospect of its becoming established is hopeful.

PARROTT (P. J.) & HARMAN (S. W.). **The Bud Moth.**—*Circ. N. Y. Agric. Expt. Sta.*, no. 109, 10 pp., 10 figs. Geneva, N.Y., 1929.

During the summer of 1928 *Eucosma* (*Spilonota*) *ocellana*, Schiff., was exceptionally abundant on apple in western New York State and caused serious defoliation and large losses in fruit yields. In one orchard 48 per cent. of the fruit was injured and in a number of others 25–35 per cent. The injury caused by the larvae is discussed [*cf. R.A.E.*, A, xvi, 143], and all stages of the insect are very briefly described. The larvae are active for 8–10 weeks and pupate during the last week in June and in July. The pupal stage lasts about two weeks or a little more; the adults then emerge, and oviposition begins about 3–4 days after pairing. The eggs, which are laid singly, generally on the lower surface of the leaves, begin to hatch in 8 or 9 days. In the middle of August the larvae start to leave the foliage and seek shelter in the axis of the buds and fruit spurs or in cracks in the bark, where they construct hibernacula in which they pass the winter. The most abundant parasite was *Trichogramma minutum*, Riley, infesting the eggs.

The use of the standard spray programme for apples, which is based on lime-sulphur and lead arsenate, is recommended. If this schedule is not used for the entire season, lime-sulphur and lead arsenate should be applied at least in the delayed dormant, pre-pink and calyx treatments. The formula for the delayed dormant application is 2½ U.S. gals. lime-sulphur, 2½–3 lb. lead arsenate, 1 U.S. pt. 40 per cent. nicotine sulphate, and 100 U.S. gals. water. As the moth prefers thick-topped trees with dense foliage and closely planted orchards, pruning the excess wood and removing worthless trees are important supplementary measures. By allowing the air to circulate freely through the trees many moths are blown out of the orchards by strong winds. In addition, spraying is carried out more easily and effectively with less material. If supplementary treatments are required for heavy infestations, nicotine sulphate at the rate of 1 qt. to 100 gals. lime-sulphur (1 : 40) may be applied just before the larvae leave their winter shelters. In the delayed dormant and pre-pink applications, the amount of lead arsenate may be increased to 4 or 4½ lb. to each 100 U.S. gals. spray. Nicotine sulphate at the rate of 1 pt. to 100 gals. spray may be used against the newly hatched larvae; in 1927 the maximum hatching occurred about 1st August.

HERVEY (G. E. R.). **Life History, Habits, and Control of the European Corn Borer in Erie and Chautauqua Counties.**—*Circ. N. Y. Agric. Expt. Sta.*, no. 107, 3 figs., 2 charts. Geneva, N.Y., 1928.

In western New York State *Pyrausta nubilalis*, Hb. (European corn borer) was more abundant than in 1927. Experiments in planting maize at different dates between 1st May and 8th June showed that the first planting was the most severely infested. The relation between the growth of the maize and the life-history of *P. nubilalis* is shown in a chart. In both cage and field tests it was found that a high percentage of the caterpillars that are ploughed under come to the surface again

in a period of time varying from a few days to three or four months, the emergence being more than 50 per cent. in many cases. It was also apparent that autumn ploughing was more effective than spring ploughing. There appeared to be little difference in the rate of emergence of the caterpillars when they were ploughed under to different depths up to 9 inches. On regaining the surface they are capable of migrating for comparatively long distances, but the mortality among these caterpillars is high. It was found that weeds on the margins of the fields were usually slightly infested up to 10 or 15 yards from the edge of the maize. The usual cultural control measures are recommended.

Guyton (T. L.) & Brown (P. G.). **European Corn Borer in Pennsylvania.**—*Bull. Penn. Dept. Agric.*, no. 469, 11 pp., 5 figs. Harrisburg, Pa., 1st December 1928.

An account is given of the appearance of *Pyrausta nubilalis*, Hb. (European corn borer) in Pennsylvania in 1919 and of its subsequent spread in that State, with notes on its life-history in the affected districts. Descriptions are given of the stages of the insect and of caterpillars likely to be mistaken for it. The remedies practised in Pennsylvania are strict enforcement of the quarantine regulations (which are quoted in detail) and of the farm practices for clearing up old stalks and disposing of them before 1st May.

Gui (H. L.). **The Potato Scab Gnat.**—*Proc. Ohio Veg. Growers' Assoc.*, xiii, 1928, pp. 24–31. (Abstract in *Expt. Sta. Rec.*, lx, no. 2, p. 166. Washington, D.C., February 1929.)

The Mycetophilid, *Pnyxia scabiei*, Hopk. (potato scab gnat) caused considerable damage to potatoes in Ohio during 1926 and 1927 [*cf. R.A.E.*, A, xv, 670 ; xvii, 31]. The eggs deposited by a single female vary in number from 16 to 103, with an average of 55, and are usually laid in the soil. The larvae hatch in 6 or 7 days, feed for about 16 days and then pupate, the pupal period lasting 3 or 4 days.

Knowlton (G. F.). **Notes on a few Species of Myzini (Aphididae) from Utah with Descriptions of two new Species.**—*Canad. Ent.*, lxi, no. 1, pp. 9–15, 7 figs. Orillia, Ont., January 1929.

Brief notes are given on the local distribution and food-plants of eight species, the most important being *Myzus cerasi*, F., on cherries ; *M. persicae*, Sulz., on peach and a large variety of other economic plants, and *Phorodon humuli*, Schr., on hops and plum.

Compere (H.). **Description of a new Species of *Coccophagus* recently introduced into California.**—*Univ. Calif. Pub. Ent.*, v, no. 1, pp. 1–3, 2 figs. Berkeley, Cal., January 1929.

A description is given of both sexes of *Coccophagus gurneyi*, sp. n., one of five species of beneficial insects recently introduced for the control of *Pseudococcus gahani*, Green (citrophilus mealybug) from New South Wales into California, where it is rapidly becoming abundant in certain orchards in which it was first colonised. In New South Wales it was bred from *P. gahani*, *P. adonidum*, L. (*longispinus*, Targ.) and two undetermined mealybugs.

Summary for 1928. —*Insect Pest Surv. Bull.*, viii, no. 10, pp. 350–369, multigraph. Washington, D.C., U.S. Dept. Agric., 1928.

The situation with regard to the more important insect pests in the United States during 1928 is reviewed. The weather conditions during the year were quite normal, and there were no outstanding entomological developments; many insects were below their normal numbers, and few reached such serious proportions as have attracted attention in previous years. Maps are given showing the present distribution of *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.), *Cydia* (*Laspeyresia*) *molesta*, Busck (which is being very well controlled in New Jersey by the parasite, *Macrocentrus ancylivora*, Roh.), *Epilachna corrupta*, Muls., and *Tibicen* (*Tibicina*) *septemdecim*, L.

Howard (L. O.). **Report [1926-27] of the Entomologist.**—29 pp. Washington, D.C., U.S. Dept. Agric., 1927. [Recd. 9th March 1929.]

Marlatt (C. L.). **Report [1927-28] of the Entomologist.**—34 pp. Washington, D.C., U.S. Dept. Agric., 1928. [Recd. 8th February 1929.]

The work of the United States Bureau of Entomology for the years 1926–27 and 1927–28 is reviewed, much of the detailed information having already been noticed from other sources.

Promising results were obtained with aluminium and zinc arsenates in experiments with various materials as substitutes for lead arsenate against the codling moth [*Cydia pomonella*, L.]. The rapid progress in the perfection of apple-washing machines for the removal of excess spray residue indicates that the continued reasonable use of lead arsenate, even under arid conditions, may be possible. Nicotine sulphate (1 : 800) used in three cover sprays, following a calyx and first cover spray of lead arsenate, gave very satisfactory results. Bands soaked in lubricating oil containing beta-naphthol, if properly made and applied, kill nearly 100 per cent. of the larvae that spin cocoons beneath them throughout the season, and up to the present no important injury to the bark has resulted from their use. Tests indicate that the larvae shelter just as readily under treated as under untreated bands. At times during the year 1926–27, 90–100 per cent. of the larvae of the oriental peach moth [*Cydia molesta*, Busck] on peach twigs were parasitised by *Macrocentrus ancylivora*, Roh. *Trichogramma minutum*, Riley, which attacks the eggs of *C. molesta*, was found to have at least 13 generations during the season, the life-cycle occupying about 8 days when the average temperature was 80° F. and 50–65 days when the average temperature was 50° F. A few individuals overwintered in the eggs of *C. molesta*.

The seasonal history of the blueberry maggot [*Rhagoletis pomonella*, Walsh] is briefly outlined, the facts being utilised in the application of calcium arsenate dust against the adults before oviposition has taken place to any extent. *Opius melleus*, Gah., is undoubtedly an important factor in the biological control of this pest, the rate of parasitism varying from 1 or 2 to 40 or 50 per cent. The adults of the parasite emerge somewhat later than those of the host, a fact that indicates the possibility of applying the calcium arsenate dust sufficiently early to kill the adults of *R. pomonella* without injuring those of *O. melleus*.

Laboratory studies on the effect of hydrogen-ion concentration on various arsenicals showed that considerable correlation exists between the scorching produced on peach foliage and the speed with which these arsenates decomposed in a solution having a pH equal to that of rain or dew, also between their toxicity to insects and the speed with which they decompose in a solution of the approximate acidity of the digestive tract of an insect. These facts suggest a possible method of predicting the probable comparative effect on insect and foliage of a series of insoluble salts of a given acid. Of the insecticides tested, acid lead arsenate was most nearly the ideal insecticide, being least rapidly decomposed at the pH of rain or dew and most rapidly decomposed at the approximate pH of an insect's digestive juices. The problem of preventing the scorching of peach foliage and fruit by arsenical sprays and dusts resolves itself into the prevention of the decomposition of arsenical salts into soluble arsenic, and this is accomplished most effectively by regulating the pH of the spray solution to the composition. It has been found that the use of Bordeaux mixture with highly refined white oil emulsions at low concentrations for summer spraying of peach trees for the simultaneous control of peach leaf curl and San José scale [*Aspidiotus perniciosus*, Comst.] tends to reduce the efficiency of the oil spray materially at concentrations up to 1·5 per cent. of actual oil ; at higher strengths under experimental conditions no difference was evident.

The most promising method of controlling the grape-berry moth [*Polychrosis viteana*, Clem.] without excessive spray residue would appear to be the intensive spraying of the vineyards with lead arsenate early in the season so that the later broods are of minor importance, supplemented by cultural measures against the over-wintering moths.

The gipsy moth [*Porthetria dispar*, L.] appears to be more abundant, and the defoliated area is rapidly increasing. Further liberations of parasites have taken place on a large scale, and collections from parts of the infested territory during 1927–28 indicated that the average percentage of parasitism was slightly greater than it was in 1926–27. Larvae of *P. dispar* were found during 1927–28 that had apparently died from the bacterial disease caused by *Streptococcus disparis*, which was introduced from Japan in 1917. Experiments with lead arsenate indicate that effective results can be obtained if the spray is applied by the time the foliage is half-grown, and the spraying season may therefore be somewhat extended. Recent tests with fish-oil as an adhesive for lead-arsenate sprays have shown that satisfactory results can be obtained with a reduced dosage of the poison, the quantity of lead arsenate being reduced from $6\frac{1}{4}$ to 5 lb. to each 100 U.S. gals. water for field application. The brown-tail moth [*Nygmia phaeorrhoea*, Don.] has been controlled to a very large extent during the last few years by imported parasites, which have proved more effective than in the case of the gipsy moth.

The application of sodium fluosilicate to sugar-cane by means of aeroplanes for the control of the sugar-cane moth borer [*Diatraea saccharalis*, F.] gave unsatisfactory results, and the soaking of seed-cane in water at air temperatures prior to planting is therefore recommended.

In connection with pests of dried fruit, experiments with storage bins that can be fumigated have shown the practicability of keeping the fruit free from insects once it has been properly stored. Chests in good condition, made entirely of properly dried red-cedar heartwood, can be depended on to protect clothing from injury by clothes moths

provided that all the older larvae are removed prior to storage. Young larvae that are present at the time of storage or that hatch from eggs present on the clothing are rapidly killed by the cedar chests. Chests should contain at least 70 per cent. of red-cedar heartwood, as the life-cycle of the moths can be completed in certain veneered chests.

In treating offshoots of date palms [*Phoenix dactylifera*] for the control of the scale [*Parlatoria blanchardi*, Targ.], it was at first considered necessary to heat them until the terminal bud was killed ; this delayed the growth of the young palm for nearly three years. Further studies have indicated that the scale can be killed at a temperature of about 115° F., whereas the bud is not killed until the temperature reaches about 127° F., and the utilisation of this margin of safety in the development of a commercial method will prevent the long setback to the offshoots.

Studies on the effect of oil sprays on *Citrus* indicate that the size of the fruit is not affected. A standard of maturity based on a certain ratio between the total soluble solids and the citric acid is demanded in nearly all States where *Citrus* is produced before the fruit can be marketed. Oil sprays reduce the percentage of total soluble solids in citrus fruits, but the reduction is all brought about shortly after the spray application. At first the decrease in citric acid is delayed by the spray, but later the acid decreases faster than in the unsprayed fruit. When the faster decrease of acid extends over a period of three or more months, the decrease is sufficient to give an increased ratio regardless of the decrease in total soluble solids. It follows, therefore, that if oil sprays are applied at least three months before the fruit is expected to reach the legal ratio, it will be advanced in maturing, but that if such fruit is sprayed within three months, its maturing is retarded. In view of the high prices paid for early fruit, delay caused by spraying may result in heavy losses, and early varieties that are to be marketed before December should therefore be sprayed before 15th July or after the fruit has been picked.

Infestation by the seed-corn maggot [*Phorbia cilicrura*, Rond.] was more prevalent under conditions that were unfavourable to the rapid germination of potatoes and where potatoes had been injured by the application of fertilisers directly to the rows. The following measures are therefore recommended : potatoes should be planted in well-drained soil at the time that is most favourable to their rapid germination ; fertilisers should be mixed with the soil at least 10 days prior to the planting of the crop ; and potatoes should be planted at a sufficient depth to prevent their being subjected to excessive moisture or very low temperatures. In connection with the sugar-beet leafhopper [*Eutettix tenella*, Baker], analyses of climatic conditions for 10 years have shown a striking relationship between the character of the summer and winter preceding a crop year and the yield of beets obtained, and this has enabled outbreaks of the insect to be predicted. Studies on the strawberry weevil [*Anthonomus signatus*, Say] showed that the earliest feeding took place on wild plants, but as soon as the strawberry buds appeared, the weevils migrated from the woodland to the strawberry fields. From catches on screens covered with adhesive placed about the edges of the fields and within woodlands, it was estimated that about 85 per cent. of the weevils hibernated in the first 100 ft. of woodland adjoining the strawberry fields. Only one generation appeared during the year in North Carolina. Infestation by the pepper weevil [*Anthonomus eugenii*, Cano] is fairly general in

the districts of California where peppers [*Capsicum*] are chiefly grown, the weevils feeding on nightshade [*Solanum nigrum*] when the pepper plants have disappeared. They have been successfully controlled by 3–11 applications of calcium arsenate dust, but it was found necessary to wash those peppers not used for canning to remove arsenical residue. In Mississippi certain dehydrated vegetables properly moistened have proved an attractive bait for the brown vegetable weevil [*Listroderes obliquus*, Gyll.], and barium carbonate has shown indications of being a suitable bait poison. For the first time the weevils were found aestivating beneath the bark of trees. A fairly satisfactory degree of control of the Arizona weevil [*Anthonomus grandis thurberiae*, Pierce] hibernating in cotton seed has been obtained by the use of steam sterilisers in gins. This weevil normally hibernates in a hard cell on *Thurberia*, but with continued breeding on cultivated cotton it has been observed that a fairly large percentage of the weevils leave this cell and hibernate in any available rubbish. Tests showed that approximately 48 per cent. of those weevils hibernating outside the cell and about 70 per cent. of those hibernating inside the cell survived the winter.

Studies on the western pine beetle [*Dendroctonus brevicomis*, Lec.] showed that fast-growing trees are most resistant to attack, and stands with a high percentage of slow-growing trees suffer the greatest injury. It is therefore suggested that selective logging would reduce the losses by removing susceptible trees. The Clerid, *Thanasimus nigriventris*, Lec., is the most important predator on *D. brevicomis*, for the adults prey on the adult bark-beetles during the flight period and the larvae feed on the bark-beetle broods. When the Clerid was artificially excluded, the emergence of the bark-beetle was 3 times as great. In control work, trees containing the summer brood of *D. brevicomis* should not be treated, as they carry over a considerable percentage of the Clerid broods until the following spring. Investigations on the Black Hills beetle [*D. ponderosae*, Hopk.] made it possible to predict the phenomenal decline in the outbreak and so saved expenditure on control. The decline was apparently due to the extremely dry summer with prevailing south-west winds, which lowered the moisture content of the trees and so interfered with the development of the beetle. Windfalls are followed by severe but short-lived outbreaks of bark-beetles in the surrounding standing timber that may cause the death of more trees than were destroyed in the original storm, and the prompt salvage of all fallen trees is the only feasible measure for preventing such damage. The best and cheapest way of controlling the white pine weevil [*Pissodes strobi*, Peck] is by planting white pine [*Pinus strobus*] in mixed stands, preferably with trees that will be of value in the final crop. Some 8 or 10 primary parasites have been introduced into Nebraska against the tip moth [*Rhyacionia frustrana bushnelli*, Busck], of which one, *Campoplex frustranae*, Cush., has already become established.

Brues (C. T.). **A Note on the Genus** *Pelecinus*.—*Psyche*, xxxv, no. 4, pp. 205–209, 4 refs. Boston, Mass., December 1928.

The genus *Pelecinus*, the problems of the systematic position of which are briefly discussed, is represented in North America by *P. polyturator*, Drury, the distribution of which extends to South America, where it varies in colour to such an extent that the numerous species of the

genus described from the tropical part of its range are possibly mere variations of it. Although the female is common in the United States, where it has been bred from the larvae of beetles of the genus *Lachnosterna* (*Phyllophaga*), the male is rarely found there. The characters distinguishing females of *P. polyturator* and *P. brunneipes*, Patton, described from Tennessee, are given, the latter being considered a subspecies of the former. In consequence of the peculiar disparity in the sex ratio, the tropical forms being bisexual and usually smaller in size, whereas the northern form is highly spanandrous and the female extremely large, it is concluded that *Pelecinus* provides a probable further example of geographical parthenogenesis, which extends the occurrence of this phenomenon to the parasitic Hymenoptera.

TAYLOR (R. L.). **The Arthropod Fauna of Coniferous Leaders weeviled by** *Pissodes strobi* **(Peck).**—*Psyche*, xxxv, no. 4, pp. 217–225. Boston, Mass., December 1928.

A list is given of 90 spiders, mites and insects obtained in the course of dissecting terminal shoots of *Pinus strobus*, *P. silvestris*, and *P. excelsa* infested by *Pissodes strobi*, Peck (white pine weevil), from various localities in Massachusetts. All parasitic Hymenoptera and several predacious Clerids are excluded from this list.

LATTA (R.). **The Effect of the extreme Temperature of Dec. 7, 8, and 9, 1927, on hibernating** *Crioceris asparagi*, **L., and** *Hippodamia convergens*, **Guér., at Ames, Iowa.**—*Psyche*, xxxv, no. 4, pp. 229–231. Boston, Mass., December 1928.

A fall in temperature from 26° F. to − 25° F. in the early winter of 1927, after a slight fall of snow that left many places exposed and followed by a rise to − 8° F., caused 100 per cent. mortality among *Hippodamia convergens*, Guér., in Iowa, where the average annual minimum temperature is − 10° F. Other Coccinellids, including two species of *Hippodamia*, were found active among the dead *H. convergens*, which was rare the following spring, whereas the other species of *Hippodamia* were quite common. An exhaustive survey of an asparagus bed infested with *Crioceris asparagi*, L., effected on the day following the period of extreme cold, revealed an almost total mortality. Most of the beetles were hibernating in the first 12 or 14 inches of the decayed organic material along the fence rows, and some were sheltering in hollow asparagus stalks, having apparently entered by the path of a previous insect or at broken internodes, without themselves boring into the stalk. Examination of stalks revealed infestation of this type varying from 22 to 52 per cent. *Anthicus* spp., which were often collected in company with *C. asparagi*, always showed activity on being disturbed. An examination of isotherms showing the average annual minimum temperatures prevailing in the United States indicated a relation between them and the northern limit of *C. asparagi* and certain other insects.

HALLOCK (H. C.). **North American predacious Insects attacking Japanese Beetle Grubs** (*Popillia japonica*, **Newman**). **(Coleop.: Scarabaeidae, Carabidae; Dipt.: Tabanidae, Therevidae, Asilidae.)** —*Ent. News*, xl, no. 3, pp. 76–78. Philadelphia, Pa., March 1929.

This is a report of extensive surveys made in the centre of the area infested by *Popillia japonica*, Newm., in New Jersey, during the

seasons 1923 to 1925 inclusive, in order to ascertain whether North American insects were helping to reduce the numbers of its larvae. At each of ten stations several plots of 1 ft. square were examined to a depth of 8 ins. about once a week, and all predators found that might be connected with the reduction of *P. japonica* were reared on its larvae in the laboratory.

Larvae of the Carabid, *Harpalus pennsylvanicus*, DeG., were found throughout the area. Other Carabids were observed occasionally, but were never abundant. There was an average of 1 larva to every 12 sq. ft. of soil examined. When placed in the soil with a larva of *P. japonica*, the Carabid pierced the skin with its mandibles and made a small hole through which the body fluids were extracted. In captivity on an average one larva was killed every 2 days.

The larvae of *Tabanus costalis*, Wied., were observed from 15th June to 20th August in fairly dry soil. In the spring and autumn they were found only along the edges of streams, but when they became larger in the summer they occurred about 1 to every 14 sq. ft. of soil examined, as far as 200 ft. from the streams. Larvae of *P. japonica* were also numerous in these localities. The Tabanid larvae fed readily on them and reached the adult stage in captivity even when kept in soil containing only an average proportion of moisture.

Larvae of the Therevid, *Psilocephala haemorrhoidalis*, Macq., were found throughout the area and occurred at the rate of 1 to every 5 sq. ft. of soil examined. In several cases they were seen to suck the body fluids of *Popillia* larvae, and in captivity they killed more larvae than the Carabids, often leaving the carcases after sucking out only part of the fluids. They are very hardy and easily reared.

The average number of Asilid larvae found was generally about the same as the Therevids. They are more difficult to rear than either *T. costalis* or *P. haemorrhoidalis*. They were very abundant in one field which had been under grass for many years, 34 being found during part of one day while the field was being ploughed. Larvae of *P. japonica* and other Lamellicorns were also plentiful in the same field. Although only a small percentage of the Asilid larvae collected matured, several individuals of *Erax aestuans*, L., and *Ommatius marginellus*, F., were reared on beetle larvae.

All these insects are predators and will undoubtedly feed on weaker predators as readily as on herbivorous insects. They have not been found numerous enough in the field to have any noticeable effect on the numbers of the Japanese beetle.

MILLER (R. L.). **Biology and natural Control of the Green Citrus Aphid, *Aphis spiraecola*, Patch.**—*Florida Ent.*, xii, no. 4, pp. 49–56, 7 graphs. Gainesville, Fla., December 1928.

The green citrus Aphid, thought by E. M. Patch to be identical with *Aphis pomi*, DeG. [*R.A.E.*, A, xii, 417], although originally described by her as *A. spiraecola*, is considered by A. C. Baker to be a distinct species in view of the fact that the male of *A. pomi* is wingless whereas that of *A. spiraecola* is winged. Although there are indications of the presence of this Aphid in Florida as early as 1922, it was not definitely recognised until 1924, after which it spread eastward in the direction of the prevailing winds with great rapidity and is now found in Florida, California, Alabama, Cuba and Honduras. Although in Florida *A. spiraecola* can attack a number of different plants, it thrives

only on *Citrus*, *Spiraea*, apple and milkweed [*Asclepias*]. Only the tender growth of *Citrus* and apple is attacked, but the Aphid can survive on tough, hard foliage or even tender stems of *Spiraea*. The greatest abundance of the winged forms occurs early in March immediately before migration. A few generations are completed on the large number of plants then attacked, but by June the Aphid can only be found on *Citrus* and *Spiraea*. [In an editorial footnote it is stated that it was numerous on *Pittosporum* in the summer of 1928.]

In contrast to the life-history of *A. spiraecola* in northern Florida, no sexual forms occur in the south, and no eggs have been observed at the citrus experiment station in Central Florida. The Aphids are active throughout the year, and from August 1926 to August 1927 44 successive first-born generations and 20 last-born generations occurred. Both sexual forms and eggs have been found at Gainesville, where the life-cycle is similar to that further to the north, the eggs being laid on *Spiraea*, apple, pear and Japanese flowering quince [*Pyrus japonica*]. The temperature here is usually 5–10° F. lower than in the south. The period required for development varied from 4 days during September to 16 days during January, the average for the year being 6·93 days. The rate of reproduction was highest in September, reached its lowest point in January and rose again, almost to the maximum, in February. During the week of the 13th September 1926 an average of 7·3 young was found to each female, the average daily rate of reproduction for the entire year being 2·98 to each female. The maximum number of young produced by a female was 103, with an average of 29·11 for each female for the year. The optimum temperature was 70–79° F., and the relative humidity 70 per cent. Longevity ranged from 11·8 days in June to 33 days in January, with an average of 16·7 days. Since foliage was present in all stages throughout the year, winged forms, which develop on hardening foliage rather than on tender succulent growth, could always be found, but were most numerous during March and April, when most of the tender foliage was hardening.

Cultural practices by which the trees are kept dormant during the winter and alternative food-plants destroyed, so as to prevent the Aphids from surviving, would be more effective in their control than the use of insecticides. The results are given of studies to determine the relative efficiency of a number of natural enemies of *A. spiraecola*, the more important of which include, in addition to some already noticed [*R.A.E.*, A, xiii, 256], *Allograpta obliqua*, Say, *Syrphus wiedemanni*, Johns., *Hemerobius* sp., *Lysiphlebus testaceipes*, Cress., and *Empusa fresenii*. The data secured indicate that when the Aphids were not increasing, their natural enemies were able to destroy a large proportion of them, but when they were breeding rapidly, the natural enemies were unable to hold them in check.

GROSSMAN (E. F.). **Florida Longevity Records of the Cotton Boll Weevil.**—*Florida Ent.*, xii, no. 4, pp. 57–59, 2 refs. Gainesville, Fla., December 1928.

Of 5,000 adults of *Anthonomus grandis*, Boh. (cotton boll weevil) placed without food in a hibernation cage in November 1927, the emergence of which was observed from 1st March until 9th August 1928, 11·24 per cent. or 562 weevils emerged, the last on 16th July after having spent 257 days without food in the hibernation cage.

In order to determine the number of days that weevils could live after hibernating, all those emerging after 14th June were provided with fresh cotton squares and placed individually in lantern globes kept in an insectary under approximately normal conditions. Longevity records show that one of these weevils lived 143 days after emergence from hibernation and another lived a total of 372 days (238 in hibernation and 134 afterwards).

Busck (A.). **A new injurious Pine Moth (Lepidoptera : Gelechiidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, pp. 13–15, 1 fig. Washington, D.C., 28th January 1929.

Recurvaria condignella, sp. n., is described from moths reared from larvae infesting the tips of the shoots of young trees of western yellow pine [*Pinus ponderosa*] in Arizona and Florida. The occurrence of the moth in Florida can be accounted for by the introduction of nursery stock from the Western States for re-afforestation.

Dyar (H. G.). **A new beneficial Moth from Panama and a Scavenger (Lepidoptera, Pyralidae, Phycitinae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, pp. 16–17. Washington, D.C., 28th January 1929.

Vitula saissetiae, sp. n., is described from moths reared from larvae predacious on *Saissetia* sp. infesting *Hibiscus* in the Panama Canal Zone. Among the moths bred from this material was a single specimen of *Ephestia declivella*, Zell., the larva of which is doubtless a scavenger.

Gahan (A. B.). **Description of an Egg-parasite of *Exophthalmus quadrivittatus* (Olivier).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, pp. 17–18. Washington, D.C., 28th January 1929.

The Eulophid, *Tetrastichus haitiensis*, sp. n., is described from Haiti, where it is a common parasite of the eggs of *Diaprepes* (*Exophthalmus*) *quadrivittatus*, Ol.

Marelli (C. A.). **Estudio sobre una peste de los eucaliptos descubierta en la Argentina.** [A Study of a Pest of *Eucalyptus* discovered in Argentina.]—*Mem. Jard. zool. La Plata*, iii, pp. 51–183, 10 pls. La Plata, 1928.

Marelli (C. A.). **Las especias invasoras pueden dar origen a nuevas especias.** [Introduced Species can give rise to new Species.]—*Rev. Chil. Hist. nat.*, xxxii, pp. 27–30, 1 fig., 13 refs. Santiago, Chile, 1928.

In the first paper an account is given of the occurrence in Argentina of the weevils, *Gonipterus gibberus*, Boisd., and *G. platensis*, Mar., infesting *Eucalyptus* [*R.A.E.*, A, xiv, 434 ; xvi, 383, etc.]. Various remedial measures have been tried. In addition to collecting and burning the larvae, pupae and adults, the eggs also were collected from the leaves. Full particulars are given of the importation of the Mymarid parasite of *G. scutellatus*, Gyll., from South Africa [xvi, 383], which has been found to parasitise the eggs of both the Argentine

species of *Gonipterus* and has been liberated in the field. A large amount of correspondence regarding the identification and synonymy of these species is reproduced.

In the second paper the problems of the origin of the Argentine species are briefly discussed, and further reference is made to their synonymy.

Borgmeier (T.). **Nota previa sobre alguns phorideos que parasitam formigas cortadeiras dos generos** *Atta* **e** *Acromyrmex*. [Preliminary Note on some Phorids that parasitise Leaf-cutting Ants of the Genera *Atta* and *Acromyrmex*.]—*Bol. biol.*, no. 14, pp. 119–126, 1 pl., 4 refs. S. Paulo, 4th December 1928.

This paper deals with 16 species of Phorids, all associated with leaf-cutting ants, which are important pests in Brazil. With the exception of *Allochaeta longiciliata*, Borgm. (*propinqua*, Borgm.), all the species are definite parasites of these ants, which they attack by inserting an egg between the abdominal segments. *Neodohrniphora acromyrmecis*, Borgm., *Apocephalus lamellatus*, Borgm., *A. rionegrensis*, sp. n., *A. dubitatus*, sp. n., *Myrmosicarius gracilipes*, gen. et sp. n., *M. catharinensis*, sp. n., *M. tarsipennis*, sp. n., *M. cuspidatus*, sp. n., *Stenoneurellys laticeps*, Borgm., and *Procliniella hostilis*, Borgm., are parasites of *Acromyrmex*. *Neodohrniphora declinata*, Borgm., *N. wasmanni*, sp. n., *Apocephalus attophilus*, sp. n., *Myrmosicarius crudelis*, sp. n., and *M. grandicornis*, sp. n., parasitise *Atta*.

Baum (G.). **Beitrag zur Biologie der Ameise** *Atta sexdens* **L., subsp.** *rubropilosa* **Forel.** [A Contribution to the Biology of the Ant, *A. sexdens* subsp. *rubropilosa*.]—*Z. wiss. Insekt Biol.*, xxiii, no. 10, pp. 243–258, 17 refs. Berlin, 31st December 1928.

This is a record of observations on the leaf-cutting ant, *Atta sexdens* subsp. *rubropilosa*, Forel, in the Brazilian state of S. Paulo, where it causes enormous losses to cultivated plants by carrying the leaves into its nests for producing the ambrosia fungus, *Rhozites gongylophora*. Swarming takes place in November at the beginning of the rainy season, and vast numbers of the queens are destroyed by birds. The ant does not attack grasses, with the exception of young maize. Introduced plants are the ones most severely damaged. Some immune plants protect themselves by exuding wax, and others by attracting other ants that drive off *Atta*. The hollow branches of *Cecropia*, for instance, are occupied by *Azteca mülleri*, Emery. Among the measures adopted against *Atta*, fumigation with compounds of arsenic or sulphur is the one most used. Opinions are divided as to the value of another ant, *Prenolepis fulva*, Mayr, for though it drives away the leaf-cutting ant, it fosters Aphids. It has been stated that the leaves of *Sesamum indicum* kill the fungus in the ants' nests, and its cultivation has been advocated.

Bondar (G.). **Relatorios annuaes de 1921 a 1927** [Reports of the Entomologist of the State of Bahia from 1921 to 1927.]—*Bol. Lab. Pat. veg.*, no. 4, 51 pp. Bahia, 1928.

The bulk of the information on insect pests given in these reports has already been noticed from various papers by the same author.

Hubbell (T. H.) & Walker (F. W.). **A new Shrub-inhabiting Species of *Schistocerca* from Central Florida (Orthoptera, Acrididae).**—*Occ. Pap. Mus. Zool. Univ. Mich.*, no. 197, 10 pp., 1 pl. Ann Arbor, Mich., 6th October 1928.

Schistocerca ceratiola, sp. n., described from Florida, has only been found on *Ceratiola ericoides* growing in sand scrub.

Monteith (J.). **Leafhopper Injury of Legumes. (Abstract.)**—*Phytopathology*, xviii, no. 1, pp. 137–138. Lancaster, Pa., January 1928.

Experiments in insect-proof cages in Virginia showed that *Empoasca fabae*, Harr., may injure most of the leguminous forage crops. In all plants attacked there was a dwarfing of the vegetative parts and a reduction in development of flowers. Tip and marginal burning of the leaves was a common symptom. Some plants showed yellowing or reddening, and others also a curling of the younger leaves. Plants may be killed, but usually the injury is localised, and even badly injured plants can recover. Although probably not of the virus class, the damage was apparently caused by something more than mere mechanical injuries. Striking differences in varietal susceptibility were observed in all the crops under observation. Resistance appeared to be due to some quality in the plant that made it less favourable for the feeding and reproduction of the leafhoppers.

Richards (B. L.). **A new and destructive Disease of the Potato in Utah and its Relation to the Potato Psylla. (Abstract.)**—*Phytopathology*, xviii, no. 1, pp. 140–141. Lancaster, Pa., January 1928.

The name "yellows" is suggested for a new and very destructive disease of potato observed in Utah, Montana and Wyoming, with which *Paratrioz cockerelli*, Sulc, is found to be associated. The early crop is most seriously affected. Experiments showed the disease to be induced in some way by the nymphs of this Psyllid. Confined in gauze bags to a single leaf, they produced the early symptoms of the disease in 9 days.

Doolittle (S. P.) & Walker (M. N.). **Aphis Transmission of Cucumber Mosaic. (Abstract.)**—*Phytopathology*, xviii, no. 1, p. 143. Lancaster, Pa., January 1928.

Experiments on the transmission of cucumber mosaic showed that *Aphis gossypii*, Glov., after feeding for five minutes on a diseased plant, transmitted the disease to healthy ones after the same period of feeding. Experiments also indicated that the Aphid loses its ability to transmit mosaic immediately after it first feeds on a healthy plant. One to ten Aphids bred on infected plants were fed for 10–20 minutes on a healthy plant and immediately transferred to another healthy plant, where they remained. Infection occurred regularly on the first plants, but the second ones remained healthy in nearly every case. The Aphids on the latter lived and multiplied, thus showing that the absence of infection was not due to injury to the Aphids. It appears that the minute amount of virus introduced into the plant tissues by the Aphid's rostrum is exhausted during the first feeding period. Aphids from diseased plants do not transmit the disease after 6–8 hours'

confinement in a test tube, this period being approximately the same as that during which the expressed juices of infected cucumber plants remain infective.

KUNKEL (L. O.). **Further Studies on the Host Range of Aster Yellows. (Abstract.)**—*Phytopathology*, xviii, no. 1, p. 156. Lancaster, Pa., January 1928.

During 1927 the number of plants known to be susceptible to aster yellows has been extended by the experimental transmission of the disease to 21 species in 13 different families, the transmission being accomplished in all cases by means of *Cicadula sexnotata*, Fall. Most of these are cultivated flowering plants. Although a great variety of plants are susceptible to the disease, many that are closely related to susceptible ones are immune. *Plantago major*, for example, is susceptible, but *P. lanceolata*, although one of the favourite food-plants of the leafhopper, is not.

HOGGAN (I. A.). **The Peach Aphid (*Myzus persicae* Sulz.) as an Agent in Virus Transmission.**—*Phytopathology*, xix, no. 2, pp. 109–123, 2 pls., 1 fig., 20 refs. Lancaster, Pa., February 1929.

Extensive greenhouse trials showed that *Myzus persicae*, Sulz., readily transmits the virus of cucumber mosaic to tobacco and certain other solanaceous plants. Comparative trials gave no evidence of transmission of the virus of tobacco mosaic by the same Aphid between the same plants. Moreover, colonies bred on tobacco plants infected with both cucumber and tobacco mosaic transmitted only the virus of cucumber mosaic, although that of tobacco mosaic was present in the leaves on which the Aphids fed. This selectivity suggests that the relation between the insect and the virus may not be purely mechanical. It is not believed that this Aphid is responsible for the dissemination of ordinary tobacco mosaic in the field.

TEHON (L. R.). **Methods and Principles for interpreting the Phenology of Crop Pests.**—*Bull. Illinois Nat. Hist. Surv.*, xvii, art. 9, pp. 321–346, 18 graphs, 21 refs. Urbana, Ill., July 1928.

This paper calls attention to a method of defining the relations of plant pests and diseases to climate and weather, pointing out the fundamental principles concerned. Its aim is rather to illustrate the potentialities of the method than to draw any final conclusions. A description is given of the two types of graph employed in the depiction of climate and weather. One, termed a hythergraph, is concerned with temperature and rainfall, and the other, a variation of the first known as a climograph, makes use of temperature and relative humidity. As records of relative humidity, although considered to be a more exact expression of climate, are not often readily available, the climograph cannot be used with the same facility as the hythergraph. The two types of graph may often be combined advantageously to show not only the ranges but also the trends of months, seasons, or other periods associated with a given phenomenon, and the variations of which the hythergraph is capable provide opportunities for correlating facts and drawing inferences relating to a wide scope of enquiries. The following new terms are employed: "thermohyet" to designate a

combination datum consisting of a record of temperature and rainfall, or any point on the hythergraph to represent such datum ; " thermohyetic " to serve as an adjective to replace such terms as " mean temperature-total rainfall " ; and " thermohyetics " to be used as a more general term with a looser meaning.

In order to illustrate the working of the method, the author applies it to certain pests and diseases of crops, and discusses the thermohyetics of *Eutettix tenella*, Baker, in relation to curly-top of sugar-beet, and of *Diabrotica vittata*, F., in connection with the bacterial wilt of melons. The fact that the abundance of the leafhopper and the severity of the disease, although usually coincident, are not always so, indicates that there are certain thermohyetic conditions influencing the incidence of the disease that are distinct from certain others that determine the abundance of the insect. A comparison of the normal thermohyetic limits of the geographic ranges of *E. tenella* and curly-top with the monthly thermohyets and annual trend in a given area indicates that whereas the growing season of the crop is undoubtedly the period of the year exercising most influence over the disease, the abundance of the leafhopper, although dependent in some measure on the weather of spring and summer, is probably influenced to the greatest extent by the hibernating period. It is apparent in a typical hibernating locality that the thermohyetic conditions of January and February in years of leafhopper abundance lie definitely within the wetter and warmer ranges of these two months.

The geographical limits in the United States of severe wilt of cucumbers caused by *Bacillus tracheiphilus*, which shows a marked sensitivity to temperature, its minimum requirement for growth being 46° F., its optimum lying between 77 and 86° F., its maximum temperature for growth being 96° F., and its death point lying at 110° F., are by no means so extensive as its range of territory and that of the beetles *D. vittata* and *D. duodecimpunctata*, Say, by which it is transmitted. Throughout the northern part of the range of *D. vittata*, where the mean annual temperature is less than 55° F., there is only one brood ; further southward, between 55 and 60° F., there is a partial second ; between 60 and 65° F. there are generally two broods ; between 65 and 70° F. there are three ; and where the annual mean temperature exceeds 70° F., there may be four broods in a year. Wilt is usually severe in the region in which the beetles generally have two broods annually and tends to be less both to the north and south of it. By arranging reports on wilt into general classes according to the severity of the disease and using annual means of temperature and totals of rainfall for the regions and years in which these degrees of disease were reported to have occurred, a hythergraph has been constructed showing the conditions under which each class of injury occurs. A generalised comparison is given of the destructiveness of the disease as determined by field examinations from 1922 to 1926, which shows a fairly steady decrease. This is not wholly attributable to the more general control of the beetle. A comparison of the normal hythergraph of Illinois and the hythergraphs for the years 1922-1926 inclusive reveals marked differences in the thermohyetic trends of the years and in the monthly thermohyets corresponding to the decrease in the amount of the disease by moving uniformly to the dry side of the graph. Whereas the normal annual rainfall in Illinois lies close to the co-ordinate marking 3 inches, the 1921–1922 season, with destructive disease, falls roughly about the

4-inch co-ordinate, the subsequent years inclining increasingly to the dry side. The year 1924–1925 lies practically on the 2-inch rainfall line, with the exception of the summer.

The paper closes with an exposition of the significance of hythergraphs, which are divided into two types, the first showing diagrammatically the progress from one month to another of individual or grouped thermohyets attending any given phenomenon, and the second constructed in such a way as to indicate by means of numerous thermohyets accompanied by good correlative data what conditions govern, or are related to, the occurrence of any given phenomena. The lines resulting from joining in series the thermohyets plotted in these hythergraphs are called " isopracts."

FLINT (W. P.) & LARRIMER (W. H.). **The Hessian Fly and the Illinois Wheat Crop.**—*Bull. Illinois Nat. Hist. Surv.*, xvii, art. 11, pp. 363–385, 3 figs., 1 map, 7 graphs, 4 refs. Urbana, Ill., August 1928.

This paper records the results of a series of experiments carried out in Illinois since 1917 to determine the effect of the date of sowing wheat on the degree of infestation by the Hessian fly [*Mayetiola destructor*, Say] in different parts of the State. A brief account is also given of the bionomics and control of *M. destructor* under conditions prevailing in Illinois, where there are at least one spring and one autumn brood, and in favourable circumstances two spring, one summer and two autumn broods in a single year. In most years the spring brood, which hatches in April, remains in the wheat stubble in the pupal stage until the middle or latter part of August, after which the adults emerge over a period of six weeks. These adults cannot survive the winter, and most of them die by the first week in October in central Illinois. If, however, they find growing wheat, they produce an autumn brood that reaches the pupal stage before the cold weather sets in and can thus withstand the lowest temperatures likely to occur in any part of the State. Under normal conditions the relatively fly-free date varies from 18th September for the northernmost part of Illinois to 9th October for the extreme south. Wheat should be sown late enough to come up and make growth at a time when there are no adults of *M. destructor* to oviposit upon it, but early enough to withstand the winter. Other control measures include suppression of self-sown wheat, maintenance of the seed bed in a state of high fertility, ploughing under of stubble from the previous crop, and growing strong-stemmed varieties of wheat that will not easily bend over. The general plan of the experiments was to give a range of six sowings extending over a period of a month, including two weeks before and two after the normal fly-free date. Tables are given showing the yield in bushels to the acre and the percentage of fly infestation for each field and each date of sowing in each year throughout the period of the experiments. The averages for the entire period are given in a series of graphs. The results show a definite relation between yield and infestation, and without any exception heavily infested wheat gave lower yields than wheat grown during the same year and in the same field but sown later to avoid the fly. The average yield invariably increased as infestation decreased. Good yields were obtained from early sowings in some years, but never when the fly was abundant. The results of this work, corroborated by field

observations throughout the State, indicate that the yield is not noticeably affected when less than 10 per cent. of the plants in a field are infested.

VON LENGERKEN (H.). **Lebenserscheinungen der Käfer.** [Life Phenomena of Beetles.]—Cr. 8vo, 147 pp., 21 figs. Leipzig, Quelle & Meyer, 1928. Price, boards, *M.* 1.80.

This booklet gives a general account of various aspects of the bionomics of beetles, with a view to encouraging the study of biological phenomena.

STROHMEYER (H.). **Insektenbeschädigungen an überseeischen Hölzern.** [Insect Injury to Overseas Timber.]—*Tropenpflanzer*, xxxii, no. 1, pp. 36–38. Berlin, January 1929.

Of recent years damage by Platypodids and Scolytids has increased in the West African soft-woods imported to Hamburg for veneers, 40-50 per cent. of these being sometimes rendered unusable. Attention is drawn to the use in England of liquid orthodichlorobenzene and solid paradichlorobenzene for spraying or dusting colonial timber. One or two ounces to 35 cu. ft. are sufficient in air-tight chambers, four or five being needed otherwise. Vayssière suggests that fumigation might be carried out during the voyage in the case of timber stacked in the holds of ships.

PARKER (H. L.) & THOMPSON (W. R.). **Contribution à la biologie des Chalcidiens entomophages.** *Ann. Soc. ent. Fr.*, xcvii, pp. 425–465, 38 refs. Paris, 1928.

Notes are given on the bionomics of twelve Chalcid parasites as observed in France, including : *Microterys ferrugineus*, Nees, from the Coccid, *Kermes* (*Kermococcus*) *roboris*, Fourc. ; *Solenotus* sp., which is an external parasite on the larvae of a species of *Agromyza* that mines the leaves of lucerne ; and *Melittobia acasta*, Wlk.

VERGUIN (J.). **La mouche des fruits** (*Ceratitis capitata*, **Wied.**).—*Rev. Zool. agric.*, xxvii, nos. 9–11, pp. 141–145, 149–163, 175–180, 6 figs., 26 refs. Bordeaux, September–November 1928.

This account of the bionomics and control of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly), which is given in view of its potential importance as a pest of fruit in France, is largely taken from the literature and includes notes on the history and geographical distribution of the fly, a description of all its stages, an account of its possible food-plants in France, and details of the different types of remedial measures employed in various parts of the world. Although not of great economic importance in France, *C. capitata* has occurred on the Mediterranean coast for a long period, and in some years causes appreciable damage. It has also maintained its existence in the neighbourhood of Paris, where only unfavourable climatic conditions have prevented it from becoming a pest since 1900, so that its distribution in France may be greater than is supposed, and it is likely to become dangerous at any moment in the south-west, where the cultivation of fruits of exotic origin is rapidly being extended.

Morgenthaler (O.). **Problems of Acarine Disease of Bees.**—*Bee Wld.*, x, no. 2, pp. 19–24, 1 map. London, February 1929.

The distribution of acarine disease of bees in Switzerland and other countries is discussed. The disease has been proved to follow the trade routes. It is propagated chiefly by infected swarms, but may also be disseminated by marauding bees or those that have mistaken their hives. Since the disease is not yet widely distributed in Switzerland, its eradication by the destruction of infected colonies is still considered possible [but *cf. R.A.E.*, A, xvi, 591]. The author points out the necessity for combating bee diseases on an international basis and the importance of preparing maps to show the distribution of the disease in the various countries affected. In 1922 a mite was discovered in Switzerland that resembled *Acarapis woodi*, Rennie (though the hind legs of the female are apparently longer), but lived externally on the bees and was never found in the tracheae. This has been named *A. externus*, and it is suggested that a knowledge of its distribution in other countries might throw some light on the origin of acarine disease. At present there is no indication that any race of bees is absolutely immune.

A study of the disease in an infected apiary showed from the distribution of diseased and healthy stocks that the colonies near an infected hive are the ones most exposed to infection, and therefore that the infection is spread in the apiary itself and not in the field, on the plants visited. During the summer it is difficult to observe symptoms with the naked eye, even in a colony where 50–80 per cent. of the bees are infected. The rate of infection decreases during the winter, and the number of infested colonies in March was lower than in the preceding months. This fact proves that bees in infected hives that are healthy in the autumn do not acquire the disease from the infected bees, and this may possibly indicate that bees are only susceptible to infection during the first few days of their lives and that the mites cannot penetrate into an old bee. The individual infection of the bee does, however, increase during the winter; the mites multiply in the tracheae, and the bee dies prematurely. In summer a normal bee usually lives only about 30 days, which is too short a time for it to be influenced by the infection, so that the fate of a colony is decided by the number of bees infected in the autumn, and this number must be very high to bring about the death of a colony. There does not seem to be any direct relation between the strength of a colony and the degree of infection, at least if the latter be below 50 per cent. The author is of the opinion that, although the progress of the disease is slow, it is one of the most important factors affecting practical apiculture. In experiments on control, chloropicrin had no apparent effect, but sulphur vapour [*R.A.E.*, A, xii, 143] seemed to give good results.

Goodwin (W.) & Martin (H.). **The Action of Sulphur as a Fungicide and as an Acaricide. Parts I & II.**—*Ann. Appl. Biol.*, xv, no. 4, pp. 623–638, 1 fig., 35 refs.; xvi, no. 1, pp. 93–103, 1 fig., 5 refs. London, November 1928 & February 1929.

Sulphur is able under certain conditions to kill mites or fungi without being in actual contact with them. This property is utilised in the horticultural practice of painting sulphur on to the hot-water pipes in greenhouses, and a similar process evidently took place in experiments on *Eriophyes ribis*, Westw. (black-currant gall-mite) [*R.A.E.*, A, xi,

538], since mites emerging from buds placed under sulphur-coated bell-jars were killed. In the first part of this paper chemical investigations into the nature of the volatile agent formed when sulphur is applied to a heated surface are described. The results indicated that the agent was gaseous elementary sulphur generated by volatilisation. In the second part experiments are described in which this conclusion was subjected to biological tests, two fungi and the mite, *E. ribis*, being employed. It was shown that the agent present in air passed over heated sulphur and responsible for the death of the gall-mite was not removed by filtration through a heated glass-wool plug, this observation being contrary to the view that the toxic agent is produced initially in solid form. Filtration through a cooled glass-wool plug only removed part of the volatile agent, and it was shown that the gall-mite is affected by traces of sulphur volatilised at ordinary temperatures. At relatively large concentrations, sulphur dioxide and hydrogen sulphide show no permanent effect on the mite, and these gases are not therefore responsible for the action of sulphur. Thus the results of these experiments confirm those obtained in the chemical investigations.

Davidson (J.). **On the Occurrence of the Parthenogenetic and Sexual Forms in *Aphis rumicis*, L., with special Reference to the Influence of Environmental Factors.**—*Ann. Appl. Biol.*, xvi, no. 1, pp. 104–134, 6 figs., 23 refs. London, February 1929.

The following is largely taken from the author's summary: Experiments were carried out on the breeding of *Aphis rumicis*, L., on *Euonymus europaeus* (winter food-plant), using broad beans (*Vicia faba*) as the alternative (summer) food-plant. The Aphids were reared in an open-air insectary or a large open glasshouse from April to October and in a heated glasshouse with varying temperatures from November to March. Parthenogenetic individuals were obtained on beans in successive generations extending over varying periods, the longest period being 2 years and 10 months (50 generations). Three types of winged parthenogenetic females occurred during the complete life-cycle. The migrants, which are produced by the stem-mother or, more usually, by her wingless progeny, occur to some extent in response to an inherent tendency associated with the migrating habit, but the numbers that arise are influenced by overcrowding and the condition of the food-plant (nutrition); they normally produce wingless individuals on the alternative food-plant. The winged dispersal forms are usually the offspring of wingless individuals on the alternative food-plant, but may be produced by winged individuals. Their occurrence is affected by overcrowding, nutrition and temperature. They normally produce wingless individuals, but under adverse conditions may also produce winged forms. The winged individuals that return to the primary food-plant and produce the wingless sexual females are the offspring of wingless individuals on the alternative food-plant. With the normal seasonal hours of daylight adult sexual forms appeared regularly in October every year, and were obtained throughout the winter until the following May when moderate mean temperatures (about 58° F.) were maintained. With higher mean temperatures (about 70° F.) during this period they only occurred occasionally; with slightly lower mean temperatures a few sexual females were obtained in every generation, but males were rare. When colonies received only 8 hours of daylight daily from the stem-mother

stage onwards, sexual females developed in June and subsequent months; males did not appear until October. No sexual forms were obtained when colonies kept at a temperature of about 70° F. received artificial light from electric lamps, in addition to the normal hours of daylight during the winter.

CUNLIFFE (N.). **Studies on *Oscinella frit*, Linn. A Report on certain Oat Varieties in Relation to their Resistance to Attack by the Frit Fly in Sweden, together with Data concerning the Production of Resistant Utility Varieties.**—*Ann. Appl. Biol.*, xvi, no. 1, pp. 135–170, 8 charts, 10 refs. London, February 1929.

As claims had been made in Sweden that varieties of oats had been established that showed marked powers of resistance to attack by *Oscinella frit*, L., the author paid a visit to the Swedish Seed Institute with the object of investigating this problem. Recent investigations in Britain have shown that the periods of maximum prevalence of the fly are fairly constant in time from season to season [*R.A.E.*, A, xii, 284; xiv, 20], that the shoot and seed are most susceptible to attack at definite stages of growth [xiv, 20], and that varieties of oat plants show variation in the extent of shoot and grain infestation when grown under similar conditions [xii, 562].

Resistance to attack may be direct or indirect, the former meaning that the plant can resist larval entry or cause the death of the larva before it has done any material damage. Direct resistance may be either constant or produced by fluctuating factors associated with growth, such as cuticular thickness, presence of silica, hairiness of surface, quality of sap, etc., in which case it may appear and vary with age. Indirect resistance includes such factors as a greater capability of producing plants and shoots per unit area, early tillering capacity (thus providing susceptible shoots for the larvae and allowing the primary shoots to escape), capacity for rapid growth, and an efficient power of recovery. It can therefore be expressed only as a comparative measure of inherent capabilities, as it is dependent on environmental conditions and will vary directly with them.

Sowings of 32 varieties of oats were made on April 25th and May 23rd, and observations were made on the infestation of the primary and secondary shoots. The results of these and certain other experiments and observations are analysed and discussed. Certain varieties seemed to show definitely high powers of resistance, and cross-breeding of these types with those of high yielding capacity (which usually seem to have low powers of resistance) has been undertaken with a view to producing a heavy yielding resistant variety.

[VUL'F (A. A.).] WULFF (A. A.). **Die Coleopterenfauna der Kiefernadel.** [The Coleopterous Fauna of Pine Needles.] [*In Russian.*]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 156–177, 2 figs., 11 refs. Moscow, 1928. (With a Summary in German.)

This is a detailed report on Coleoptera collected on pine needles in the summer and autumn of 1926 and 1927 in the vicinity of Leningrad, and a list is given of 116 species taken. The majority of these had no direct relation to pines. The reason for the occurrence of numerous Elaterids, which are of no economic importance in the adult stage, requires further investigation. The fauna of pines depends to a great

extent on meteorological and ecological factors, and the effect of these is discussed in detail. The author divides the beetles into four categories, namely, those that feed on needles and shoots, those that attack these pests, beetles of no economic importance, and those that occur on pines occasionally.

[Vitomskiĭ (N. F.).] **Витомский (Н. Ф.). Beitrag zur Kenntnis von** *Eccoptogaster morawitzi*, **Sem. (Coleoptera, Ipidae).** [*In Russian.*]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 178–184, 8 figs., 2 refs. Moscow, 1928. (With a Summary in German.)

In the summer of 1926 *Scolytus* (*Eccoptogaster*) *morawitzi*, Sem., was found on *Larix sibirica* in the Government of Nizhni-Novgorod; hitherto this Scolytid had only been recorded from the Transbaikal region. A detailed description of the male, which was hitherto unknown, is given, and the characters distinguishing *S. morawitzi* and *S.* (*E.*) *intricatus*, Ratz., are indicated. The former is the only species of the genus that attacks coniferous trees in Europe.

Under natural conditions the adults were on the wing in the first half of July and the period of the flight was very extended, so that freshly laid eggs occurred at the end of August and beginning of September. The females bore in the sap-wood, making deep galleries ending with reniform cells, in which 5–30 eggs are laid. Immediately after oviposition the female dies, blocking the entrance into the gallery with its body. The larvae make further galleries, which sometimes attain 8 inches in length Hibernation occurs in the larval stage. *S. morawitzi* chiefly attacks drying branches not exceeding 4 inches in diameter, but sometimes occurs in the trunk. Females under observation did not oviposit in healthy branches, as the sap flooded the galleries.

Masaĭtis (A. I.) & Mamaev (K. A.). **Notice sur la sauterelle-pélérin asiatique dans le district de Kamen en Siberie.** [*In Russian.*]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 233–234. Moscow, 1928.

Isolated larvae and adults of *Locusta migratoria*, L., were found on several occasions in the Kamen district of Siberia, at latitude 53° 43′ N., showing that this locust not only occurs so far north, but can even breed there.

[Nikol'skiĭ (V. V.).] **Никольский (В. В.). On the biological Method of controlling Insect Pests.** [*In Russian.*]—*Khlopkovoe Delo*, viii, no. 1, pp. 51–61, 16 refs. Moscow, January 1929.

This is a general discussion on the importance and efficacy of the biological method of controlling insect pests, particularly by the introduction of their natural enemies, with detailed notes on its successful application in various parts of the world. The history of the origin of this method is briefly reviewed, and the difficulties involved in its application are pointed out. Some of these would not arise if the method were applied against the pests of cotton in Russian Central Asia, as the fields occupy vast areas, where no other plants are cultivated and weeds are in most cases destroyed, so that polyphagous parasites and predators would be bound to concentrate their activity exclusively on cotton pests. Moreover, the latter are not numerous, the principal

ones being Aphids, *Heliothis obsoleta*, F., and the red-spider [*Tetranychus telarius*, L.]. The last two cause enormous damage in the Caucasus, but considerably less in Central Asia.

WEBSTER (J. F.). **Notes on the Oviposition Habits of** *Eurygaster integriceps* **in Northern Iraq.**—Correspondence, 1929.

In a letter to the Director of the Imperial Institute, London, the author states that in the wheat fields of Northern Iraq, *Eurygaster integriceps*, Puton, lays its eggs on the lower surface of the leaves of certain weeds. In most countries the eggs are laid on the wheat itself, but the climate of the infested regions of Iraq is apparently too hot and dry to allow the eggs to survive on wheat, and the habit of the insect is modified.

The weeds concerned were subsequently identified at Kew as *Leontice leontopetalum*, *Cirsium rhizocephalum*, *Texiera glastifolia*, *Belleralia ciliata* and *Bangardia chrysogonum*.

ZONDAG (J. L. P.). **Aantekeningen over de Atlasvlinder.** [Notes on *Attacus atlas*.]—*De Natuur*, xlix, no. 1, pp. 17–20, 8 figs. Santpoort, 15th January 1929.

Attacus atlas, L., has been recorded from a number of food-plants of economic importance, which may be defoliated in severe infestations. The observations described were made in Java, where this moth is a pest of mahogany, though it appears to prefer *Erithrina lithosperma*, *Spondias dulcis*, and *Barringtonia spicata*. The caterpillars are used as food by the natives; their natural enemies include birds, geckos and Dipterous parasites. They do not occur in the presence of the ant, *Oecophylla smaragdina*, F., which is, however, a pest in other respects. *A. atlas* pupates in a cocoon spun between a few leaves, and the pupa may be attacked by small red ants. Under favourable conditions the pupal stage requires 3–3½ weeks, but it lasts through the east monsoon. It is possible that great moisture as well as great drought may prolong this stage. Emergence and mating occur in the evening, the female laying about 150 eggs.

VAN DER GOOT (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1927.** [Diseases and Pests of Cultivated Plants in the Dutch East Indies in 1927.]—*Meded. Inst. PlZiek.*, no. 74, 85 pp. Buitenzorg, 1928.

Many of the pests recorded were mentioned in the two previous reports [*R.A.E.*, A, xiv, 520; xvi, 190]. Others include *Scirpophaga innotata*, Wlk., *Pachydiplosis oryzae*, Wood-Mason, *Atherigona exigua*, Stein, *Leptocorisa acuta*, Thunb., *Spodoptera mauritia*, Boisd., *Thrips oryzae*, Williams, *Schoenobius bipunctifer*, Wlk., and *Cnaphalocrocis medinalis*, Guen., on rice; *Thrips tabaci*, Lind., on onions; *Herse convolvuli*, L., on sweet potato; *Mylabris pustulata*, Thunb., and *Lachnosterna* (*Holotrichia*) *helleri*, Br., on *Glycine hispida*; *Brontispa longissima*, Gestro, on coconut; *Sesamia vuteria*, Stoll (*nonagroides*, Lef.) and *Valanga nigricornis*, Burm., on maize; *Aleurolobus* (*Aleurodes*) *longicornis*, Zehnt., *Diatraea venosata*, Wlk. (*striatalis*, Sn.), *Colobathristes saccharicida*, Karsch, and *Aphis maidis*, Fitch, on sugar-cane; *Lachnosterna helleri*, *Zeuzera coffeae*, Nietn., and *Hyblaea puera*,

Cram., on teak; *Hypsipyla robusta*, Moore, and *Attacus atlas*, L., on mahogany; *Xyleborus morigerus*, Bldf., on *Crotalaria* and *Leucaena glauca*; *Terias hecabe*, L., and *Xystrocera festiva*, Pasc., on *Albizzia*; *Chauliops bisontula*, Banks, on *Calopogonium*; *Setora nitens*, Wlk., *Andraca bipunctata*, Wlk., and *Heterusia risa*, Dbld., on tea; *Tiracola* (*Arcilasisa*) *plagiata*, Wlk., and *Saissetia* (*Lecanium*) *nigra*, Nietn., on *Hevea*; and *Oreta extensa*, Wlk., *Pagodia heckmeyeri*, Heyl., and *Xyleborus morstatti*, Hag., on coffee.

Hazelhoff (E. H.). **Onderzoek witte luis in aanplant 1927-1928.** [Investigations on the White Woolly Aphis in Sugar-cane Fields in 1927–1928.]—*Arch. Java-Suikerind.*, 1927; reprinted as *Korte Meded. Proefst. Java-Suikerind. Pasoeroean*, no. 86, pp. 599–602. Soerabaia, 1927.

An outline is given of the methods to be followed by sugar planters in Java in assisting to investigate the importance of the Chalcid, *Encarsia flavoscutellum*, Zehnt., in the control of the sugar-cane woolly aphis [*Oregma lanigera*, Zehnt.]. The results of the observations made have already been noticed [*R.A.E.*, A, xvi, 628; xvii, 233].

Andrews (E. A.). **Red Spider.**—*Quart. J. Ind. Tea Ass.*, 1928, pt. 4, pp. 206–219, 4 diagrs. Calcutta, 1928.

In north-east India, *Tetranychus bioculatus*, W.M. (red spider) all stages of which are described, lives in colonies on the upper surface of the leaves of the tea plant. The eggs are laid on the upper surface, often along the ribs. It is estimated that the adult stage is reached in five days. Pairing takes place immediately after the emergence of the female, and eggs are laid the same day; so far as can be observed the females live a long time, depositing eggs singly at intervals. Wherever there is a flourishing colony, the leaf is covered with a tangled mass of very fine web, along and under the strands of which the mites move. This web acts as a protection from wind, rain, etc., and greatly impedes the action of sprays and dusts. As the mites feed, the leaf gradually turns a reddish-brown, the sides curl upwards, and, if the attack is severe, it eventually drops off. In the first instance they always attack the old leaves, and only affect the buds and young leaves in extreme cases. They are distributed by running from leaf to leaf and bush to bush, or by the wind, being supported by long silk threads. When the trees are heavily pruned the mites may enter a kind of hibernating stage in crevices in the bark. Two Coccinellids, *Chilomenes sexmaculata*, F., and *Scymnus* sp., and the larva of a lacewing fly prey on the mites, and the larva of a Staphylinid has been observed sucking the eggs. The mites feed on a variety of plants including *Tephrosia candida*, *Derris robusta* and many jungle plants, but can complete their life-cycle on tea, which may be attacked at any stage of its growth.

Observations made on tea plantations are discussed. Since climatic conditions were uniform, the only possible explanation of the fact that mites occurred on bushes where there was no trace of injury is to be found in a difference in the condition of the plants. A comparison of the bushes pruned annually with those pruned biennially indicated that unpruned bushes are more susceptible to attack.

On areas subject to red spider attack, all trees should be pruned and all useless wood and twigs should be removed each year. Where the soil readily becomes baked, the outbreaks of red spider that sometimes occur in August, especially when on young tea, may be due to this cause, and the use of a trench hoe down the lines has given good results. The use of insecticides is discussed. It seems possible that the known advantage of applying sulphur dust while the dew is still on the bushes may be due to the weight of water pressing down the web and thus allowing a closer contact between the particles of sulphur and the mites. Lime-sulphur sprays, if thoroughly applied, also appear to be effective.

RAMSAY (A. A.). **Liquid Hydrocyanic Acid. Its Use in Citrus Fumigation.**—*Agric. Gaz. N.S.W.*, xl, pt. 1, pp. 55–57. Sydney, 1st January 1929.

A brief account is given of the methods employed since 1917 in the manufacture of liquid hydrocyanic acid and of the type of plant at present in use for its production from sodium cyanide or crude calcium cyanide. The present cost of production is believed to be about 2*s.* 5*d.* per lb., and the retail price varies from 2*s.* 6*d.* to 2*s.* 11*d.* per lb. Some account is given of the application of liquid hydrocyanic acid in liquid form by means of atomisers or in the form of warm gas by means of vaporisers. Though the latter are more costly, they are thought to afford more rapid diffusion of the fumigant. The difficulty of maintaining the stability of the liquid acid is pointed out, and the process of diffusion of the gas is described. The systems employed in fumigation in California and the results secured there with liquid hydrocyanic acid in *Citrus* orchards are briefly discussed. The cost of fumigating small trees from one to three years old is stated to be about 10*d.*, and of big trees from 4*s.* 1*d.* to 5*s.* 2*d.*, the average cost being from 1*s.* 5*d.* to 1*s.* 8*d.*

COCKERELL (T. D. A.). **Biological Control of the Prickly Pear.** —*Science*, lxix, no. 1786, pp. 328–329. New York, N.Y., 22nd March 1929.

These notes on some of the Arthropods imported into Australia to destroy prickly-pear include a brief discussion of the species of *Dactylopius*. These are morphologically very much alike, but they differ biologically and attack different species of *Opuntia*. The author distinguishes seven species. *D. coccus*, Costa (*signoreti*, Ckll.) is the commercial cochineal. *D. opuntiae*, Ckll., is the insect usually called *D. tomentosus*, Lamarck, the exact identity of the latter being probably impossible to determine. *D. confusus*, Ckll., is common in the Rocky Mountains of Colorado and New Mexico, and in other south-western States, but the material from Ceylon, South Africa and Florida ascribed to this species may not all pertain to it. *D. greeni*, n.n. (*Coccus confusus capensis*, Green, nec *C. capensis*, L.) was described from South Africa, but is of American origin. It occurs on *Opuntia monacantha* and has been imported into Australia. *D. ceylonicus*, Green (*indicus*, Green) is indigenous in Argentina and has been imported into Australia, India and Ceylon. It is very effective against *O. monacantha*, though the related *O. dillenii* is practically immune. *D. newsteadi*, Ckll., was described from Arizona and has been imported into Australia.

D. argentinus, Dominguez, occurs in Argentina on *O. ficus-indica* and *O. aurantiaca*. The author does not know whether this is a valid species, but its food-plants are not susceptible to attack by *D. opuntiae*.

Wells (W. G.). **Queensland. Report on the Work of the Callide Cotton Research Station, Biloela, for the Year ending June 30, 1928.**—*Reps. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 1–30, 2 charts, 5 refs. London, 1929.

Thrips tabaci, Lind., occurred in large numbers during the dry period prior to the October rains. All early planted cotton suffered an appreciable loss of terminal buds, but it is believed that October storms came sufficiently early to destroy the insects before the November and December plantings could be damaged. The absence of *Euxoa radians*, Guen., during the past season is more or less correlated with conditions of abundant rainfall at certain critical periods. The value of poisoned bran mash against this cutworm is pointed out In the spring a very serious outbreak of *Heliothis obsoleta*, F. (corn earworm) occurred in many fields of standover cotton, the clearing of an excessive growth of weeds from which had been delayed, and 2 acres of newly planted cotton were destroyed in a few days by a migration of caterpillars from these fields. On a 60-acre field, which adjoined a small, infested standover plot, the caterpillars not only damaged the bolls and squares, but also cut off the tips of the main stalks and branches. Parasites and predators caused a marked reduction in the February and March broods. Systematic examinations of bolls showed that the pink bollworm [*Platyedra ? scutigera*, Holdaway] is to a large extent being controlled at the Station by raking up and burning the plants, which are first cut by a slide-cutter.

Parsons (F. S.). **Report on the Work of the Cotton Experiment Station, Candover, Magut, Natal, for the Season 1927-1928.**—*Reps. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 55–89, 3 pls., 5 charts, 5 refs. London, 1929.

Dysdercus spp. first appeared in numbers on cotton in April, species of *Abutilon*, *Hibiscus*, *Sida* and *Cienfugosia* probably being more attractive to them during March, which was hot and rainless. Experiments to test the apparent relationship between sowing date and incidence of the stainers and boll disease show that, at corresponding reaping dates, the longer exposure to these insects of first developing bolls in plots planted on 28th November and 6th December gives rise to the heavier percentage of stained cotton in these, as compared with the percentage in the plots planted on the 2nd and 15th November.

The Eumolpid, *Syagrus rugifrons*, Baly, which overwinters in the adult stage, was unusually numerous, owing to the presence of an exceptionally early food-supply provided by large blocks of ratoon cotton in fresh leaf, the infestation being more widespread than usual and the damage severe. It has been shown [*R.A.E.*, A, xvi, 351] that one application of calcium arsenate dust at the rate of 5 lb. to the acre destroys 90 per cent. of the beetles infesting seedling cotton. It is, however, doubtful if the heavier and frequent applications required to dust large plants would result in as high a mortality, and cattle, which are allowed to pasture on standover cotton in the early spring, would be in danger of becoming poisoned by the dusted foliage. No

beetles were found on plants grown in two fields that had been notorious for beetle depredations but were allowed to lie fallow the previous season.

During December, *Heliothis* (*Chloridea*) *obsoleta*, F. (American bollworm) caused considerable loss of buds in some localities. *Diparopsis castanea*, Hmps. (Sudan bollworm), which was numerous in August and September, was moderately abundant only from October to December in certain fields of ratoon cotton, in which cattle had not been kept, but infestation, severe in some parts, was again observed in the following March. This increase in bollworms about March is now regarded as normal. Notes are given on experiments with light traps, which were carried out from 28th November to 15th April. Males greatly preponderated, but nearly all the females captured showed a large egg-laying capacity. Large numbers of *Cosmophila auragoides*, Guen., a minor pest of cotton, were also trapped during December.

Trichogramma lutea, Gir., was reared from the eggs of *D. castanea*. *Lonchaea aurea*, Macq., was bred from bolls bearing a frothy substance on the exterior, and may be regarded as an agent in the natural control of this bollworm. *Cienfugosia hildebrandti* is now definitely stated to be a food plant of *Diparopsis* [*cf. loc. cit.*]. It bears from 2 to 25 capsules, and these are frequently found to contain full-grown larvae.

Sorghum suffered severely from Aphids, and *Busseola fusca*, Fuller (stalk borer) destroyed nearly all the plants in the early sown plots. These were ratooned, but as the borer again became evident, they were treated, to a large extent successfully, with a carbolic sheep dip (kerol), 1 : 350.

Observation rows of bambara groundnuts (*Voandzia subterranea*) were attacked by the Jassid, *Empoasca facialis*, Jac. ; an infested crop is difficult to harvest owing to the slender peduncles breaking when the plants are lifted.

MacDonald (D.). **Swaziland. Report on the Work of the Cotton Experiment Station, Bremersdorp, for the Season 1927-1928.**—*Reps. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 97–108, 1 chart. London, 1929.

Empoasca facialis, Jac., appeared soon after the January rains, and by early February its effect on the cotton crop was very noticeable, the attack increasing in severity until the end of March. The greatest damage was done in the low veldt areas, where a drought occurred in February and March. Only a few individual plants in the plots of Jassid-resistant strains showed themselves susceptible to attack. A few plantations suffered from *Diparopsis castanea*, Hmps. It was observed in small numbers from as early as 5th December, but only about the middle of March did a heavy infestation occur. *Oxycarenus* appeared in large numbers in early March, but *Dysdercus* not till a month later. From then onwards these cotton-stainers increased rapidly, the proportion of stained cotton increasing with successive pickings and being very high with the later ones. Cotton-seed traps proved of little use until the bulk of the crop was picked, but have since given good results.

PEAT (J. E.). **Southern Rhodesia. Cotton-breeding Station, Gatooma: Report for the Season 1927-28.**—*Repts. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 110–135, 3 pls., 5 charts. London, 1929.

The Jassid [*Empoasca facialis*, Jac.] was again the most serious insect pest of cotton. Blocks of the most susceptible variety grown were planted among the observation blocks as indices of the attack and to provide for the breeding of the insect. About the middle of January, odd nymphs were noticed on both resistant and susceptible strains, and from the end of this month to the end of June weekly counts of them were made, the results of which for twelve of the more interesting strains are tabulated. The numbers on the more susceptible varieties increased during February, but decreased considerably in March, probably owing to drought. After the rains at the end of March, the numbers again increased in April, but decreased in May, when the plants became withered and unattractive. A few nymphs were present on intermediate and resistant strains early in the season, but later hardly any were to be found on them. In April the numbers increased again on these, nearly according to their susceptibility, but at this time the more susceptible strains were proving unattractive. With the advent of dry, colder weather the attack died away. The method of determining the hairiness of the leaves is described, and the relationship between the hairiness of certain varieties and their resistance to Jassid attack is discussed. It may be stated generally that, taking into consideration both the density and length of the hairs, the hairier the plant the greater its resistance [*R.A.E.*, A, xvi, 353].

Almost complete control of *Dysdercus* was again effected by the use of seed traps and by hand-picking [*cf. loc. cit.*], the season being abnormally dry. The former were unsuccessful against adults, but a large number of broods hatched on them in April and May, and were easily killed, the traps being renewed every fortnight and the old seed burned. The adults invaded the plots from the surrounding veldt from early March to mid-June, and more than 140,000 must have been caught on the plants, many of the females showing a large egg-capacity. The author considers that similar control work could have been economically carried out on a farm scale during the last two seasons. In a study of the most suitable bait, crushed and uncrushed cotton seed proved equally attractive, but when soaked in cotton-seed oil, attracted only a few stainers.

As in the preceding year damage by bollworms was slight. Outbreaks of Aphids occurred both in February and in May and June. Records of termite damage on over 4,000 plants were kept, and a loss of 13 per cent. was incurred between 12th January and 10th February. During the next two weeks 3·1 per cent. of the remaining plants were lost, and a further decrease of 1·6 occurred in March.

At the planting season, larvae of Tenebrionids, chiefly those of *Trachynotus geniculatus*, Haag., and possibly also of *Zophosis* and *Dasus* (*Gonocephalum*) *simplex*, F., attacked the germinating seed and very young seedlings, especially those of one variety. Experiments with baits for the adults, with a view to preventing an attack next season, were apparently successful, since at the conclusion few could be found alive. The most effective bait was 1 lb. Paris green to 180 lb.

maize meal mixed into a thick paste with water. Small quantities were scattered under shade, débris or grass, and these became effective again on being moistened when further adults had emerged.

KING (C. B. R.). **Nyasaland. Report on Entomological Work on Cotton, Season 1927-28.**—*Reps. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 250–255. London, 1929.

In continuation of experiments with light traps against the red bollworm, *Diparopsis castanea*, Hmps. [*R.A.E.*, A, xvi, 354], it was found that a 200 candle-power acetylene light, which is described, is effective over a square area of about 10 acres, and is approximately the minimum economic strength that can be used in full moonlight, the light being burned for 4 or 5 hours after dusk. Hand-collecting was entirely dispensed with, the trap alone being depended on. The latter was brought into use on 24th January 1928, when the larger plants began to show squares, though no rain had fallen for 5 weeks and insects were very scarce. Captures were general in March and April, and some moths were taken up to 9th May, after which time the trapping was discontinued. The yield of cotton was considered satisfactory. The total cost of trapping was about £2. 6*s.* an acre on a 5-acre plot, the length of which was twice the width. The American bollworm [*Heliothis obsoleta*, F.] was freely caught in the traps, but the appearance of *Earias* was erratic. Some individuals of *D. castanea* were taken some distance from cotton at a place where cotton was last grown in 1926, and it is inferred that this moth can spend a complete year in some resting stage. From the results of trapping, it is concluded that the moths emerging from November to March all belong to the same generation, no second generation occurring during this period.

The appearance of *Dysdercus* towards the end of February seems to be fairly regular every year. Seed-trapping is not considered a valuable method of control; it would seem best to try to obtain maturity of the cotton before stainers become numerous, by the selection of early maturing varieties, by early planting where possible or by ratooning. The natural enemies of stainers are quite insufficient to cope with them. *Phonoctonus*, a Reduviid much resembling *Dysdercus* and predacious upon it, appeared in larger numbers than usual, but did not seem to act as a check on the latter to any extent.

ANSON (R. R.). **Fiji. Report on the Work of the Cotton Experiment Station, Sigatoka, for the Season 1927-1928.**—*Reps. Expt. Stas., Emp. Cott. Grg. Corp., 1927–28*, pp. 266–278, 1 pl., 1 chart. London, 1929.

A Jassid was very prevalent during March, April and May, but disappeared with the advent of dry weather, and most of the attacked cotton rapidly recovered, one variety proving resistant. Until the latter part of the season, *Dysdercus insularis*, Stål, was kept in check by hand collection. On certain cotton hybrids that are almost trees, various adhesive bands were tried; one material from America prevented all the nymphs from reaching the cotton, only a few adults being found in the bolls. It is, however, too expensive to be used on a commercial scale. *Dacus passiflorae*, Coq., could not be found on cotton in 1927–28 despite a careful search, and the incidence of *Earias*

fabia, Cram., was slight [*cf. R.A.E.*, A, xvi, 356]. It is probable that *Platyedra gossypiella*, Saund., was kept in check by parasites, as it caused very little damage.

GOLDING (F. D.). **A first Survey of Insect and Fungoid Incidence on improved Ishan Cotton.**—*7th Ann. Bull. Agric. Dept. Nigeria*, pp. 17–37, 15 refs. Lagos, 1928.

This paper describes the results of a survey of the factors affecting the development during 1927–28 of two selected strains of *Gossypium vitifolium* and one of *G. peruvianum*, sown in early July, and of another native strain, probably *G. vitifolium*, sown on 1st June. Infestation by *Dysdercus* was unusually slight, although the stainers were observed to be numerous in October, adjacent to cotton, on bulrush millet [*Pennisetum typhoideum*], on which a generation matured in November. Adults and nymphs were also observed in September feeding within two miles of cotton on *Hibiscus esculentus*, *H. sabdariffa*, *Adansonia digitata* and *Urena lobata*. Other Rhynchota attacking cotton included the Pentatomids, *Nezara viridula*, L., *Halydicoris scoruba*, Dall., *Agonoscelis versicolor*, F., and *Atelocera raptoria*, Germ., and the Coreids, *Anoplocnemis curvipes*, F., and *Riptortus* sp., all of which, except the first, are recorded for the first time as pests of cotton in Nigeria. The first two attained the status of major pests, and boll rots were not uncommon in spite of the scarcity of *Dysdercus*. Rhynchota seen on cotton but not observed feeding on the bolls were the Pentatomids, *Callidea natalensis*, Stål, and *Piezodorus pallescens*, Germ., and the Lygaeids, *Lygaeus rivularis*, Germ., and *Aspilocryphus fasciativentris*, Stål. Bollworm damage to mummified and harvested bolls was greater than in any previous survey. *Diparopsis castanea*, Hmps., was the commonest species while the bollworm infestation was at its height in December, but the larvae were not seen after that month. *Earias biplaga*, Wlk., and *E. insulana*, Boisd., were also numerous, adults of *E. biplaga* being seen in the field from January to March. Shed fruits of tangerines attacked by *Argyroploce leucotreta*, Meyr., were deeply buried, and only a few of these bollworms were found later on adjacent cotton. *Empoasca facialis*, Jac., was abundant on cotton planted on poor soil, adjacent late flowering strains of *G. vitifolium*, which have pubescent leaves, suffering considerably less damage. From 9·8 to 56 per cent. of these plants, however, were attacked late in September by *Sylepta derogata*, F., whereas only 2·2 per cent. of plants of *G. peruvianum* were affected. *Helopeltis* spp. were very rare. Some dying plants showed signs of root damage by larvae of *Syagrus calcaratus*, F., or of stem damage by Buprestid larvae (probably *Pseudagrilus sophorae*, F.).

Crops grown from cotton through yams flowered about three weeks later than those from cotton alone, and except for the last six weeks of harvesting, were cleaner. Plant bugs, which appear to prefer the late-flowering strains of *G. vitifolium* to *G. peruvianum*, were responsible for the greater degree of staining late in the season. If this later infestation proves to have been abnormal, these strains, which were cleaner and of considerably greater value than *G. peruvianum*, although the latter gave a higher yield in the current season, are likely to produce on a larger scale in a normal year. They were markedly resistant to Jassids and leaf-curl (a virus disease thought to be transmitted by Aleurodids), and are less exposed to injury by *Dysdercus*, owing to

their later flowering. In the season under survey, however, loss from boll shedding and mummification was from 10 to 17 per cent. greater in the case of the selected strains of *G. vitifolium* than in that of *G. peruvianum*. The earlier planted native strain, in addition to being susceptible to leaf-curl and Jassids, flowers too late to be of any practical value when grown through yams.

GOLDING (F. D.). **Notes on the Yam Pest, *Heteroligus claudius*, Klug, in the Benin and Warri Provinces of Nigeria.**—*7th Ann. Bull. Agric. Dept. Nigeria*, pp. 38–43, 2 refs. Lagos, 1928.

Observations made in the course of an investigation carried out between May and July 1927 on the Dynastid, *Heteroligus claudius*, Klug, in various localities of the Benin and Warri provinces of Nigeria, where damage to yams was reported in 1924 and 1925, indicated that this beetle is only of importance at Benin City on early sown yams, and in three other localities in certain years. In another locality *H. claudius* was a serious pest until 1923, when a communal system of planting was instituted. In 1927 the only locality in which damage from the beetle was recorded as serious was one in which the time of planting is considerably earlier than in any other. *H. claudius* appears to be numerous about every third or fourth year, and if few or no beetles are found on test yams planted in February or March in the vicinity of Benin City, planting is carried out in May. If, however, beetles are numerous, planting is delayed until mid-June, the farmers having found that late-sown yams are almost entirely immune from attack. The small number of beetles taken in light traps from May to July suggests that the main migratory period occurs earlier. In a wire gauze cage containing 10 seed yams into which 19 beetles were introduced on 27th May and 20 more at intervals up to 7th June, soil investigations showed the majority of beetles at a depth of 4–8 inches on 13th June, at 8–12 inches on 11th July and at 12–24 inches on 1st August, one beetle being found at 30 inches. Seed yams planted experimentally on 18th May were free from beetles until 29th June, when 5 yams showed traces of attack, and investigation of the crop showed an average of 11·3 per cent. of the tubers attacked. Although exhaustive search for the larvae on decayed timber and in other places in the vicinity of yam plantations gave negative results, it has since been discovered [see next paper] that the breeding season does not begin until October.

LEAN (O. B.). **A Dynastid Beetle as a serious Pest of Yams in the Benue Province of Nigeria.**—*7th Ann. Bull. Agric. Dept. Nigeria*, pp. 44–56, 1 ref. Lagos, 1928.

This is a report on the progress of the attack of *Heteroligus claudius*, Klug, on yams in 1927 in the Benue Province of Nigeria, where the almost total destruction of the crop in certain areas involves famine among the native population. Information collected in regard to previous attacks indicates that slight infestation follows good early rains. The beetles are supposed to appear at the beginning of the rains and to disappear again in October, the attack being at its height in June and July. Severe outbreaks are remembered many years ago, and the beetle reappeared in numbers in a few localities in 1919, but it was not until 1925 that the attack became general and of major

importance. The beetle was probably at its worst in 1926; although the attack in 1927 was severe, the area of infested territory was somewhat reduced. The only control measure hitherto in use has been the employment of light traps in the form of fires built in the yam fields beside pots sunk in the ground and filled with water; these are not effective. The factors governing the distribution and intensity of the 1927 infestation are discussed, and differences in the methods of cultivation in the immune and infested regions are pointed out. Yams grown on higher, well-drained ground in the infested area suffered less than those in small valleys near streams. In the southern districts, which are generally immune, an effort is made to plant the yams before the first rains, and they may reach full size by the end of July, whereas in the infested region of the north, planting is delayed until well into the rainy season, in May or June, and the yams are not full-grown till September.

In 1927 the first beetles were caught at light traps in one district on 23rd May, but they did not appear generally until the middle of June. Beetles seemed to become increasingly numerous until August and September and were still found in small numbers in October. It seems impossible to detect the infested yam heaps by the condition of the vines, since the beetles only destroy the seed and new tubers and do not attack the ordinary root-system. Toward the end of the rains, they bury themselves deep in the yam heap, and the dry weather appears either to kill them or to induce migration. Beetles were reported flying at night in November. Many of them were of a smaller type towards the end of the season. Cage experiments indicated that the weight of yam consumed by the beetle was very low, the average for each adult being only 1–2 gms. of seed yam a week. The beetles refused all the possible alternative food-plants placed in their cages except a small quantity of potato tubers. They proved to be very long-lived when confined in cages with damp earth and with yams for food, and even without food they survived from 18 to 92 days. Mating was not observed until September, and oviposition was first observed on 19th October, continuing until 23rd December. The eggs are laid in the soil at varying depths, though never near the surface and not necessarily near a yam tuber. In an experiment 8 females laid 117 eggs during 7 days in wet soil and none in dry; in another experiment 21 eggs were laid in ordinary soil from yam fields as compared with 11 in stream soil containing rotting vegetable matter. The oviposition periods of 4 females varied from 13 to 32 days, and the average number of eggs laid in various cages was about 40 per female.

The egg stage lasted from 12 to 26 days, the larval stage from 93 to 141, and the pupal stage from 13 to 20. A description of the larva is given. Larval mortality was heavy in breeding experiments, and only 16 adults were reared. Pupation generally took place in the soil, but some of the larvae in the cages came to the surface to pupate. Pupation continued from February to May, but the majority pupated in April. Although *H. claudius* has been bred in cages, neither eggs, larvae nor pupae have yet been found in the field. As, however, feeding on yams or some possible substitute appears to be necessary to complete metamorphosis, the most likely breeding-places would be in the lower levels of old yam fields, or deep in the soil in the yam heaps. If this proves to be the case, the beetle could be effectively controlled by scattering the heaps after the yam harvest to expose the larvae and pupae to the heat of the sun. Early sowing to give the

plant a start before the coming of the beetle, and early harvesting as opposed to leaving the yams in the ground until required for food, would probably be efficacious as preventive measures under the conditions prevailing in Benue Province, but general co-operation would be essential to secure success. Other control measures suggested include hand-collection, staking the yams, and trap crops, but light traps were not found efficient.

ROSTRUP (S.). **Kruesygeangreb i korsblomstrede planter i 1926 og 1927.** [Outbreak of Leaf-curl on Crucifers in Denmark in 1926–27.]—*Tidsskr. Planteavl.*, xxxiv, pp. 692–716. Copenhagen, 1928. (With a Summary in English.)

Leaf-curl on crucifers, caused by the swede midge, *Contarinia nasturtii*, Kieff., first observed in Denmark in 1909, has since occurred annually in varying intensity, but was never of great general importance until 1926, when practically all swede and cabbage fields in Eastern Jutland and the Islands were infested, the damage being greatly intensified by a bacterial infection. The injury caused to the plants is described [*cf. R.A.E.*, A, xvi, 2]. The attack began in 1926 at the end of May or beginning of June and lasted till late autumn; in 1927 it began about mid-July and usually ended sooner. In 1926 the first generation of larvae were at work from the end of May to the end of June, the second in July, the third in August and September, and the fourth (in some places) in October, or possibly only to the end of September. The attack was most severe, at all events at first, near fields where swedes had been grown in the previous year. In most cases crops sown early (prior to 25th April) seem to have been the most resistant, the smaller plants suffering the greater damage.

Die Bekämpfung von Forstschädlingen mit Borchers "Hercynia"-Kalkarsenat. [The Control of Forest Pests with Borchers Hercynia Brand of Calcium Arsenate.]—16 pp., 15 pls. Goslar, Gebr. Borchers Aktiengesellschaft, 1929.

This publication deals with various points connected with the use of a proprietary calcium arsenate dusted from an aeroplane against forest pests. The times at which dusts should be applied against various Lepidoptera and sawflies are indicated, and the results of successful experiments in different parts of Germany against the nun moth [*Lymantria monacha*, L.] are discussed by Dr. Wolff of the Forestry High School at Eberswalde, who supervised some of them.

BLUNCK (H.). **Die Erforschung epidemischer Pflanzenkrankheiten auf Grund der Arbeiten über die Rübenfliege.** [The Investigation of Outbreaks of Plant Pests and Diseases on the Basis of Work against the Beet-fly.]—*Z. Pfl Krankh.*, xxxix, no. 1, pp. 1–28, 8 pp. refs. Stuttgart, January 1929.

The development of investigations on outbreaks of plant pests and diseases in Germany and the factors governing their origin, course and recurrence are discussed. In the case of the beet-fly [*Pegomyia hyoscyami*, Pz.], its possible limitation by parasites is checked by cold weather. This necessitates a study of methods for restoring the

disturbed balance of nature or reducing the injury caused. These include crop rotation, etc., direct measures against the pest, or the breeding of crop varieties resistant to attack. Progress in studying the epidemiology of the beet-fly has been achieved in mobile field experiment stations, which provide effective means of conducting investigations of this character.

ZACHER (F.). **Ein für Deutschland neuer Schädling an Backobst *Carpophilus ligneus*, Murr., und andere Saftkäfer.** [*C. ligneus*, a Pest of Dried Fruits new to Germany, and other Nitidulid Beetles.]—*Mitt. Ges. Vorratsschutz*, v, no. 1, pp. 2–5, 3 figs. Berlin, January 1929.

Since the first European record of *Carpophilus ligneus*, Murr., in 1922 in England [*R.A.E.*, A, x, 238], the author has repeatedly found this Nitidulid in Californian dried plums in Berlin. Nitidulids are the most common Coleopterous pests of dried fruits; *C. hemipterus*, L., often occurs in Bosnian plums. Popular descriptions are given of these two species and of *C. decipiens*, Horn, another North American species long established in Germany. The beetles oviposit on over-mature or fallen fruits in the field, or on harvested fruits that are being dried on trays. In a subtropical climate development from egg to adult occurs within 4 weeks, and must be quite short in Germany in a heated store-room. The various generations overlap. Both the larvae and adults eat fresh and dried fruits, but the chief loss is due to their presence and excreta. Cacao beans, wheat, groundnuts, etc., are also infested. When only a few beetles occur in a parcel of goods, these should be uniformly heated to 70° C. [158° F.]. Prevention is a matter of manufacture and storage; store-rooms can be successfully fumigated with sulphur or hydrocyanic acid gas.

UHLMANN (E.). **Zur Abwehr von Vorratsschädlingen durch bauliche Ausgestaltung gefährdeter Betriebe.** [Protection against Pests of stored Products by Structural Changes in the threatened Premises.]—*Mitt. Ges. Vorratsschutz*, v, no. 1, pp. 8–10. Berlin, January 1929.

Some instances are cited of infestations of stored products by *Sitodrepa panicea*, L., and other pests, attention being drawn to the need for care in designing and constructing buildings so that pests may not be able to enter or breed inside them. Wire gauze screens over the windows, abundance of daylight, and the absence of narrow corners and similar refuges are among the desirable features.

PAILLOT (A.) & PUSSARD (R.). **Sur l'opportunité économique du traitement contre le carpocapse.**—*C.R. Acad. Agric. France*, xv, no. 6, pp. 210–214. Paris, February 1929.

An account is given of spraying against *Cydia* (*Carpocapsa*) [*pomonella*, L.] on pears in the Rhône Valley. The orchard, which had

received no treatment during the winter, was sprayed for the first time on 16th April, after the fall of the petals, and again 15 days later, with a mixture consisting of 10 lb. copper sulphate, 15–30 lb. powdered hydrated lime, 7½ lb. calcium arsenate paste (35 per cent. tricalcium arsenate), 1 lb. casein and 100 gals. water. Each application necessitated the use of 130 gals. of spray, and the total cost of both operations, including labour, was about £5 for 295 trees. Whereas 90 per cent. of the fruit in neighbouring orchards was infested, the percentage in the treated orchard was only 12–18. The importance of using a spraying apparatus with at least 12 lb. pressure, so as to reach the calyx of the fruit, which is the part most vulnerable to attack, is pointed out.

FEYTAUD (J.). **Les chenilles du prunier.**—*Rev. Zool. agric.*, xxvii, no. 7, pp. 110–114, 1 fig. Bordeaux, July 1928.

In continuation of papers on the Lepidopterous pests of plums in the south-west of France [*R.A.E.*, A, xvi, 499, 623], notes are given on the bionomics and control of the following minor pests: *Aporia* (*Leuconea*) *crataegi*, L., *Malacosoma neustria*, L., *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhea*, L.), *Porthetria* (*Lymantria*) *dispar*, L., and various Tortricids, including *Eucosma* (*Tmetocera*) *ocellana*, Schiff., *Argyroploce* (*Penthina*) *variegana*, Hb., and *A.* (*P.*) *pruniana*, Hb.

FEYTAUD (J.). **Les vers de la prune.**—*Rev. Zool. agric.*, xxvii, no. 12, pp. 181–189, 2 figs. Bordeaux, December 1928.

Several insects attack the fruit of plums in the south-west of France. The adults of *Rhynchites cupreus*, L. (and sometimes of *R. bacchus*, L.) appear in May and June and bore into the young shoots. The females lay their eggs in the fruit and then gnaw partly through the penduncle so that the fruit falls to the ground in the slightest wind. The larvae continue to feed in the fallen fruit and at the end of 5 or 6 weeks bury themselves in the ground to pupate. The adults are formed in the autumn, but do not emerge until the following spring. In France this weevil is usually of minor importance on plums, but in Italy it is often very injurious. The measures recommended include the collection and destruction of fallen fruit and the spraying of the trees in April and May.

The adults of the Tortricids, *Cydia* (*Grapholitha*) *funebrana*, Tr., and *C.* (*G.*) *prunivorana*, Rag., appear in May and June and lay their eggs on the outside of the plums. The young caterpillar burrows into the fruit and before reaching maturity has often destroyed two or three plums. There is usually at least a partial second generation. The larvae generally pass the winter in cocoons in cracks in the bark of the trunk. The control measures recommended are the collection and destruction of fallen fruit, the use of shelter bands, the scraping of the bark and subsequent application of washes, and spraying.

The larvae of *Hoplocampa fulvicornis*, Panz., and possibly other sawflies of the same genus, also attack plums [*cf. R.A.E.*, A, xii, 375, etc.].

Goidanich (A.). **Su di un dittero parassita endofago di formiche.** [An endophagous Dipterous Parasite of Ants.]—*Fiume*, vi, reprint 15 pp., 4 pls. Fiume, Soc. Studi fiumani, 1928.

An account is given of the biology and morphology of the Phorid, *Apocephalus schmitzi*, Men., parasitising *Cremastogaster scutellaris*, Ol., at Fiume.

Papers noticed by Title only.

Ferris (G. F.). **The Principles of Systematic Entomology.**—Super Roy. 8vo, 169 pp., 11 figs. London, Humphrey Milford [1929]. Price, cloth, 12*s.* 6*d.* [*Cf. R.A.E.*, A, xvii, 192.]

Box (H. E.). **Informe preliminar sobre el descubrimiento en la República Argentina de una especie de** *Diatraea* **nueva para la fauna americana.** [Preliminary Report on the Discovery in Argentina of a Species of *Diatraea* new to the American Fauna.]—*Rev. Ind. agríc. Tucumán*, xix, no. 3–4, pp. 97–103, 2 figs. Tucumán, August–September 1928. [See *R.A.E.*, A, xvii, 24.]

Cleare, jr. (L. D.). **A Method for the Rearing of Egg Parasites of the Sugar-cane Moth-borers** [*Diatraea*].—*Agric. J. Br. Guiana*, ii, no. 1, pp. 20–29, 2 pls., 3 figs. Georgetown, March 1929. [See *R.A.E.*, A, xvi, 652.]

Walley (G. S.). **A new** *Campoplegidea* [*C.* (*Viereckiana*) *ellopiae*, sp. n.] **parasitic on** *Ellopia fiscellaria* **Gn.** [in Ontario] (**Hymen., Ichneumonidae**).—*Canad. Ent.*, lxi, no. 1, pp. 22–23. Orillia, Ont., January 1929.

Cushman (R. A.). **A Revision of the North American Ichneumon-flies of the Genus** *Mesostenus* **and related Genera.**—*Proc. U.S. Nat. Mus.*, lxxiv, art. 16, no. 2761, pp. 1–58, 8 figs. Washington [D.C.], 1929.

Beauverie (M. A.). **Les maladies à virus d'après les travaux récents.** [Information on Virus Diseases taken from recent Literature.]—*Rev. Bot. appl.*, viii, nos. 81–82, pp. 334–339 & 404–410, 17 refs. Paris, May & June 1928.

[Baranov (N.).] Baranoff (N.). **Studien an pathogenen und parasitischen Insekten I. Die Jugoslavischen Arten der Tachinidengruppe** *Echinomyia* (**Fauna der Jugoslavischen Tachiniden I**) [Studies on pathogenic and parasitic Insects, I. The Jugoslavian Species of the Tachinid Group *Echinomyia*.]—*Arb. paras. Abt. Inst. Hyg. Schule Volksgesundheit Zagreb*, no. 1, 22 pp., 1 pl., 5 figs. Zagreb, 1929. Price *RM.* 2.

Chrystal (R. N.) & Myers (J. G.). **The Sirex Woodwasps and their Parasites.**—*Emp. Forestry J.*, vii, no. 2, pp. 145–154, 5 pls. London, 1928. [*Cf. R.A.E.*, A, xvi, 652; xvii, 154, 158.]

Metalnikov (S.) & Chorine (V.). **Maladies microbiennes chez les chenilles de** *Pyrausta nubilalis* **Hbn.**—*Ann. Inst. Pasteur*, xlii, no. 12, pp. 1635–1660; xliii, no. 1, pp. 136–151, 8 figs., refs. Paris, December 1928 & January 1929. [*Cf. R.A.E.*, A, xvii, 212.]

Frappa (C.). **Sur un ennemi du caféier à Madagascar (le bostriche du caféier)** [*Xyleborus coffeae*, Wurth].—*Agron. col.*, no. 133, pp. 15–20. Paris, January 1929. [See *R.A.E.*, A, xvii, 193.]

Daviault (L.). **Notes biologiques sur la bruche du haricot** (*Acanthoscelides obtectus* **Say**). [Notes on the Biology of *Bruchus obtectus*.]—*Nat. canad.*, lv, no. 8, pp. 171–176. Quebec, February 1929. [*Cf. R.A.E.*, A, xv, 203; xvii, 192.]

Langston (J. M.). *Phyllophaga* [*Lachnosterna*] **of Mississippi.**—*Tech. Bull. Mississippi Agric. Expt. Sta.*, no. 15, 103 pp., 13 pls., 3 pp. refs. A. & M. College, Miss., October 1927. [Recd. April 1929.]

Kendall (J.). **A new Gall Mite on** *Prunus maritima*, **Wang.** [*Eriophyes maritima*, sp. n.]—*Psyche*, xxxv, no. 4, pp. 210–212. Boston, Mass., December 1928.

Weber (H.). **Kopf und Thorax von** *Psylla mali* **Schmidb.** (**Hemiptera-Homoptera.**) **Eine morphogenetische Studie.** [Head and Thorax of *P. mali*. A morphogenetic Study.]—*Z. Morph. Oekol. Tiere*, xiv, no. 1, pp. 59–165, 35 figs., 43 refs. Berlin, 12th March 1929.

Takahashi (R.). **Notes on some Formosan Aphididae** [including 4 new Species].—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 100, pp. 92–103, 5 figs. Taihoku, Formosa, February 1929.

Cockerell (T. D. A.). *Drosicha burmeisteri* **Westwood apparently rediscovered** [in Siam] (**Coccidae**).—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, p. 16. Washington, D.C., 28th January 1929.

Uvarov (B. P.). **Notes on some Caucasian Pamphaginae** (**Orthoptera, Acrididae**).—*Rev. russe Ent.*, xxii, no. 3–4, pp. 148–155, 2 figs. Moscow, 1928.

[Znoĭko (D. V.).] **Знойко (Д. В.). Zur Systematik der Acrididen der Steppenzone des Europäischen Russlands, nebst einer kurzen Uebersicht der russischen** *Omocestus* **und** *Myrmeleotettix*-**Arten** (**Orthoptera, Acridodea**). [On the Classification of the Acridids of the Steppe Area of European Russia together with a short Synopsis of the Russian Representatives of *Omocestus*, Bol. and *Myrmeleotettix*, Bol.] [*In Russian.*]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 185–201, 13 figs., 2 pls., 23 refs. Moscow, 1928.

[Shestakov (A.).] **Шестаков (А.). Ad cognitionem Braconidarum tribus Agathidini. I.** [*In Russian: descriptions in Latin.*]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 223–228. Moscow, 1928.

[Predtechenskiĭ (S. A.).] **Предтеченский (С. А.).** *Chorthippus volgensis*, **sp. n.** (**Orthoptera, Acridodea**) **aus dem Gebiet der unteren Wolga.** [*Chorthippus volgensis*, sp. n., from the Lower Volga Region.]—*Rev. russe Ent.*, xxii, no. 3–4, pp. 229–230, 4 figs. Moscow, 1928.

[Dekhtyarev (N.).] **Дехтярев (Н.). The Insecticides and Fungicides now available on the Market and Methods for their Application.** [*In Russian.*]—*Visn. Plodov. Vinogr. Gorodn.*, iv, no. 1, pp. 26–32. Kharkov, January 1928.

Federley (H.). **Methoden zur Erforschung der Vererbung bei den Lepidopteren.** [Methods for the Investigation of Heredity in Lepidoptera.]—*Handb. biol. Arbeitsmeth.*, Abt. ix, Teil 3, Heft 3, (Lief. 290), pp. 637–690, 2 figs., 56 refs. Berlin & Vienna, Urban & Schwarzenberg, 1929. Price (Heft 3, pp. 501–690), *M.* 10.

Travassos (L.). **Contribuição preliminar á systematica dos nematodeos dos arthropodos.** [Preliminary Contribution to the Classification of the Nematodes parasitising Arthropods.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 5, pp. 19–25, 2 pls. Rio de Janeiro, 1929.

Meilhan (J.). **Sur la vanesse du chardon** (*Pyrameis cardui* **L.**) **parasite de l'artichaut.**—*Rev. Zool. agric.*, xxvii, nos. 11–12, pp. 165–175, 190–196, 1 pl., 1 fig., 12 refs. Bordeaux, November & December 1928.

During 1928 *Pyrameis cardui*, L., caused considerable damage to plantations of artichokes (*Cynara scolymus*) in the south-west of France. The butterflies appeared in large numbers at the beginning of May and hovered over the locality for two or three days before selecting two relatively restricted areas of the field for oviposition, and it is remarkable that during a similar invasion in 1918 approximately the same places were selected, the butterflies choosing in both cases those areas where, owing to various reasons, the plants were not yet fully grown. Insecticides were applied at these points, and in the less important foci the infested leaves were removed and buried in deep trenches. By 26th May all the butterflies had disappeared, and few caterpillars were observed, but during the first week in June new flights of butterflies appeared. Other areas were selected for oviposition, but control measures were again applied, and by the beginning of July the worst danger was over. The worn condition of the adults points to the fact that they were migrants, possibly from Africa. The migrations of this species are discussed. Practically nothing is known of their causes, but they nearly always take place in very hot years and during the blowing of the Sirocco, a dry wind from Africa.

The eggs are laid singly on the leaves and hatch in 8–10 days. The larva nearly always spins a web on the lower surface of the leaf, beneath which it feeds for about 15 days. It then migrates, usually to the upper surface, and rolls the leaf from the tip, only leaving this shelter when all the parenchyma has been consumed. In the case of an outbreak, when the larvae are extremely numerous, their habits are somewhat modified ; the young caterpillars live in hundreds beneath a common web on the lower surface, and the older ones migrate rapidly, spin no webs and eat without stopping except to moult. The larvae are polyphagous, and if there is a shortage of their preferred food-plant, they will attack many other plants, including beans and cardoons (*Cynara cardunculus*). After feeding for about a month the larvae pupate, usually on the under side of some horizontal support. The pupal stage lasts about 14 days, making the duration of the total life-cycle about two months. There may be two or rarely three generations a year. The winter is usually passed in the adult stage, though occasionally pupae of the last generation may overwinter and give rise to adults in the following spring.

The control measures recommended are the picking and destruction by burying or burning of all the most infested leaves and the treatment of the remainder with nicotine. Although lead and calcium arsenates proved even more effective than nicotine, their use is not permissible on plants to be used for food. In experiments with entomogenous fungi in the laboratory, caterpillars attacked by *Beauveria effusa* were killed in 8–10 days, but it was difficult to obtain a sufficient number of cultures for field tests, and moreover the slowness of their action renders them of doubtful value. It is also suggested that artificial shelters might be constructed where the caterpillars would pupate in large numbers and from which the pupae could be collected and destroyed. In certain cases Hymenopterous parasites destroy almost all the larvae and pupae, and insectivorous birds, particularly

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sparrows, account for a large number. Since no pairing was observed and no eggs were laid in the insectary, the author suggests as a possible explanation of the total disappearance of the pest after a severe outbreak, that long flights may influence the maturation of the genital organs, the sporadic occurrence of indigenous individuals of *P. cardui* being accounted for by an adaptation to a less active mode of life.

[Golovyanko (Z. S.).] **Головянко (З. С.). Results of the Application of Paradichlorobenzene for the Control of the Larvae of *Polyphylla fullo*, L., in the Vineyards of the Lower Dnieper Sands.** [*In Russian.*]— *Visn. Sadiv. Vinogr. Gorodn.*, 1929, no. 1–2, reprint 15 pp., 1 ref. Kharkov, 1929.

In continuation of previous work [*R.A.E.*, A, xvi, 293] paradichlorobenzene was applied on a large scale in 1928 in the vineyards of the lower Dnieper for the control of *Polyphylla fullo*, L. A detailed account is given of the results obtained; these were estimated at the end of September and beginning of October, and the differences in the number of uninfested plants in treated and untreated areas and of the larvae that occurred there are shown as percentages. In the treated parts of the vineyard the total number of plants damaged by the larvae did not exceed 5 per cent., whereas in the untreated ones nearly half the plants were infested. The number of uninfested plants is directly proportionate to the increase of the dosage of the fumigant, up to a rate of about $\frac{1}{3}$ oz. (10 gm.). Whereas 75 per cent. of the treated plots were entirely free from the larvae of *Polyphylla* and partly so from those of other Lamellicorns (chiefly *Anomala*), only 11 per cent. of the untreated ones were uninfested. The experiments of 1928 showed that the effectiveness of paradichlorobenzene depends greatly on the temperature and the depth at which the larvae occur in the soil. The work was less effective than in 1927, owing to cold and dry weather, in consequence of which the paradichlorobenzene evaporated slowly, and the larvae penetrated deeper into the soil in search of moisture. The worst results were obtained from the treatment of vineyards in early April, and the best at the end of May. The increase of the dosage by 10–20 per cent. did not influence the efficacy of the fumigant to any extent, and a better method would be to apply it at smaller intervals. Care should be taken to cover the soil as soon as possible; it can be used to the best advantage by planting the vine stocks closer in order to obtain a greater number of fumigated seedlings, and not by planting other crops amidst the stocks.

[Vasil'ev (I. V.).] **Васильев (И. В.). On the Race of the Ukrainian *Phylloxera*.** [*In Russian.*]— *Vestn. Vinodel. Ukrainui*, xxx, no. 1, pp. 13–14, 4 refs. Odessa, January 1929.

The author shares the opinion of Börner as regards the existence of two distinct races of *Phylloxera* [*R.A.E.*, A, xi, 342, 433; xii, 556], and the literature on the subject is briefly reviewed [*R.A.E.*, A, vi, 56; xii, 188, 478; xiv, 518; xv, 559]. It is pointed out that a knowledge of the biological peculiarities of the two races is of great practical importance when choosing the grafting stocks, as those immune from infestation by the northern race (*vastatrix*) suffer from the southern one; it should also be taken into consideration that while *vastatrix* is

easily transported on roots, *vitifolii* concentrates on nodosities on one-year-old roots and usually disappears in the spring. On the basis of the characteristics determined by Börner, the author states that both races occur in the Ukraine. The occurrence of *vitifolii* he deduces from characters of the rostrum and from the fact that the chief American vines used in the Ukraine as grafting stocks are often heavily infested with leaf-galls; on the other hand, most of the *Phylloxera* in the Ukraine hibernate on the lignified roots of the vines, which is typical of *vastatrix*, and in some years galls were observed on certain European vines. These observations, however, require confirmation.

[Dekhtyarev (N. S.).] **Дехтярев (Н. С.). Pests of Vines in the Ukraine.** [*In Russian.*]— *Vestn. Vinodel. Ukrainui*, xxx, no. 1, pp. 15–20, 5 refs. Odessa, January 1929.

This is an account of investigations in 1927 and 1928. The local distribution of *Phylloxera* is discussed in detail. Pests attacking the leaves of vines included *Empoasca* (*Chlorita*) sp., *Drepanothrips reuteri*, Uzel, *Phaneroptera falcata*, Scop., *Lethrus apterus*, Laxm., *Adoxus* (*Bromius*) *obscurus*, L., *Byctiscus betulae*, L., *Clysia ambiguella*, Hb., *Sparganothis pilleriana*, Schiff., *Deilephila* (*Celerio*) *livornica*, Esp., *Pergesa elpenor*, L., *Eriophyes vitis*, Land., and *Labidostomis* sp. The stems were severely infested by root Aphids, and by *Lecanium corni*, Bch., and *L. persicae*, F. *Euxoa segetum*, Schiff., which often occurs together with *Feltia* (*E.*) *exclamationis*, L., is a serious pest of young vines and seedlings. The roots were injured by larvae of Elaterids and of *Melolontha* spp., *Pentodon idiota*, Hbst., and *Polyphylla fullo*, L., the last-named usually occurring together with the larvae of *Anoxia pilosa*, F., *A. villosa*, F., and *Anomala praticola*, F. *Sciaphobus squalidus*, Gyll., often occurred on the buds, and *Cetonia aurata*, L., *Epicometis* (*Tropinota*) *hirta*, Poda, *Oxythyrea funesta*, Poda, and *Omophlus lepturoides*, F., on the flowers.

[Diamandidi (M.).] **Диамандиди (М.). The Infestation by *Phylloxera* of certain American Vines and Hybrids under artificial Conditions.** [*In Russian.*]— *Vestn. Vinodel. Ukrainui*, xxx, no. 1, pp. 27–30, 3 refs. Odessa, January 1929.

This is an account of experiments carried out near Moscow in the summer of 1928 with a number of American vines and hybrids, in order to determine their resistance to the attacks of *Phylloxera*. A list of the vines used is given, together with notes on the degree of infestation; but the author states that, owing to the small scale of the experiments, no definite conclusions could be made as regards the immunity of the various vines.

[Kazas (I.).] **Казас (И.). On the Introduction of Quarantine Measures against *Phylloxera* in the Ukraine.** [*In Russian.*]— *Vestn. Vinodel. Ukrainui*, xxx, no. 1, pp. 21–23, 1 ref. Odessa, January 1929.

This is a discussion of the way in which *Phylloxera* becomes distributed in the Ukraine. It is imported into the country on grafting stocks from France, which are themselves immune, and spreads to local stocks.

[Kazas (I.).] **Казас (И.). The Organisation of Measures against *Phylloxera* in the Ukraine.** [*In Russian.*]—*Vestn. Vinodel. Ukrainui*, xxx, no. 3, pp. 138–146, 2 refs. Odessa, March 1929.

This is a detailed review of quarantine measures against *Phylloxera* begun in the Ukraine in 1928. The vine-growing regions have been divided into three zones according to the degree of infestation; their geographical boundaries and characteristics and the special measures practised in each zone are discussed. Fumigation of native seedlings from nurseries with hydrocyanic acid gas, after exposing the roots to the open air for about 15 minutes and before packing the seedlings for transport, was very effective. The difficulty of fumigating seedlings imported from abroad, owing to various reasons of a purely technical character, is pointed out.

[Dekhtyarev (N. S.).] **Дехтярев (Н. С.). Termites injurious to Vine-stocks.** [*In Russian.*]—*Vestn. Vinodel. Ukrainui*, xxx, nos. 2–3, pp. 84–89, 146–150, 1 fig., 20 refs. Odessa, February & March 1929.

This is a detailed but popular account of the bionomics of *Reticulitermes* (*Leucotermes*) *lucifugus*, Rossi, which is an important pest of vines in the Odessa region. The larvae and adults are fully described. Cotton wool pads, soaked in carbon bisulphide and placed in the soil amongst the vines at short intervals and at a depth of about 2 to 4 inches, are very effective against this termite, or if the nest occurs inside the stem of the vine, a small hole should be bored in the wood and a fairly large quantity of carbon bisulphide poured into it, the hole being sealed up immediately. Cyanogas calcium cyanide powder, blown into the nests by means of a special apparatus, kills the termites almost instantaneously. Previous workers have recorded successful results with baits of a thick starch paste, sweetened with molasses and mixed with arsenic, or of bread or wood paper soaked in a solution of arsenic, but the author considers that further experiments should be made to find a bait that the termites would prefer to any other food.

[Simirenko (L. P.).] **Симиренко (Л. П.). Forest and Garden Hazelnuts.** [*In Russian.*]—*Visn. Plodov. Vinogr. Gorodn.*, iv, no. 1, pp. 17–26, 16 refs. Kharkov, January 1928.

This paper includes brief notes on the insects attacking hazel [*Corylus*] in the Crimea. The larvae of *Curculio* (*Balaninus*) *nucum*, L., feed on the kernel of the nut. In June the female bores through the soft shell of the nut and deposits an egg in the kernel. The only remedial measure known is to shake the weevils from the trees on to sheets in the early morning or late afternoon. The larvae of *Oberea linearis*, L., mine the heartwood of young shoots and the centres of the buds, causing them to wither and fall. The withered shoots containing the larvae should be cut off and burnt. *Xyleborus* (*Tomicus*) *dispar*, F., sometimes causes considerable damage also. The most important pest, however, is *Lecanium corni*, Bch., which spreads rapidly on trees growing in shady and damp areas, whereas those in sunny places, with sufficient space for the access of air, remain free from infestation. Strips should therefore be felled in woods of hazel, and the undergrowth should be removed. Infested trees should be felled and taken away, and small branches and litter should be burnt.

Box (H. E.). **La "Lagarta Rosada" del algodonero** (*Pectinophora gossypiella*, **Saunders). Una plaga que no queremos tener en Tucumán.**—*Rev. ind. agríc. Tucumán*, xix, no. 3–4, pp. 106–110, 5 figs. Tucumán, August–September 1928.

This is a popular review of the distribution and importance of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., throughout the world, including notes on its control by the fumigation of cotton seed. The pest has not been recorded from the province of Tucumán, though it occurs in other parts of Argentina.

Cleare, jr. (L. D.). **Report on the Working of the Biological Division.**—*Rep. Dept. Sci. & Agric. Br. Guiana 1927*, Appx. ii, pp. 21–24, Georgetown, 1929.

Some of the pests mentioned in this report were recorded in the previous one or have been discussed elsewhere [*R.A.E.*, A, xvi, 465; xvii, 24, 25]. Young sugar-cane seedlings were protected against *Laphygma frugiperda*, S. & A., by screening with muslin, as they were too delicate for arsenical treatment. Shipments of *Ipobracon grenadensis*, Ashm., and *Microdus diatraeae*, Turn., parasites of *Diatraea*, were sent to Barbados and Antigua. Coconut palms were damaged in Georgetown by *Brassolis sophorae*, L., which is likely to cause periodical defoliation unless the control measures recommended are made compulsory. Several cabbage palms (*Oreodoxa oleracea*), which succumb to a first attack of *Castnia daedalus*, Cram. (coconut stem borer), have recently been killed by it. *Ligyrus ebenus*, DeG., which has been causing severe damage for some 15 years to tannias (*Xanthosoma*), appears to attack the yellow variety in preference to the white, which might be cultivated more extensively. *Cosmopolites sordidus*, Germ., which is not known to occur in the Colony, was intercepted in a shipment of banana suckers from Trinidad.

Franklin (H. J.). **Cape Cod Cranberry Insects.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 239, 67 pp., 4 pls., 68 figs., 7 refs. Amherst, Mass., February 1928.

This bulletin is the first part of a paper on the pests of cranberries in Massachusetts and deals with larval forms attacking the foliage, buds and fruit. This group embraces the majority of cranberry insects and includes the following species, many of which are only occasionally injurious to this plant: *Rhopobota vacciniana*, Pack. (black-headed fireworm), which the author hesitates to consider identical with the European *R. naevana*, Hb., *Peronea minuta*, Rob. (yellow-headed fireworm), *Gelechia trialbamaculella*, Cham. (red-striped fireworm), *Tortrix* (*Cacoecia*) *parallela*, Rob. (spotted fireworm), *Xylina* (*Calocampa*) *nupera*, Lint. (false armyworm), *Epiglaea apiata*, Gr. (cranberry blossom worm), *Agrotis c-nigrum*, L. (spotted cutworm), *A. ipsilon*, Hufn. (black cutworm), *Cirphis unipuncta*, Haw. (armyworm), *Laphygma frugiperda*, S. & A. (fall armyworm), *Itame* (*Cymatophora*) *sulphurea*, Pack. (green cranberry spanworm), *Ematurga amitaria*, Guen. (*Epelis truncataria* var. *faxonii*, Minot) (brown cranberry spanworm), *Cleora pampinaria*, Gn. (cotton spanworm), *Abbotana clemataria*, S. & A. (big cranberry spanworm), *Cingilia catenaria*,

Drury (chain-spotted geometer), *Porthetria dispar*, L. (gipsy moth), *Mineola vaccinii*, Riley (cranberry fruit-worm), *Anthonomus musculus*, Say (cranberry weevil), *Dasyneura vaccinii*, Smith (cranberry tipworm) and *Pristiphora idiota*, Norton (cranberry sawfly). Notes on the bionomics and control of each of these insects are given, and their distribution and food-plants are discussed. All stages of the insects are described, and keys are given for their identification.

Robinson (W.). **A Study of the Effect of Surgical Shock on Insects.**—*J. Agric. Res.*, xxxvii, no. 12, pp. 743–748, 3 figs.

Robinson (W.). **Determination of the Natural Undercooling and Freezing Points in Insects.**—*Ibid.*, pp. 749–755, 3 figs. Washington, D.C., 15th December 1928.

In low-temperature studies on insects, undercooling and freezing-point determinations provide valuable data. The method of making the determinations that involves piercing the insect produces shock to the organism and gives inaccurate readings of temperature. A means of making determinations by contact is described, and detailed instructions for the construction of a contact thermocouple are given.

Wolcott (G. N.). **Notes on the Life-history of** *Exophthalmus quadrivittatus* **Olivier (Coleoptera).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 2, pp. 21–26, 1 ref. Washington, D.C., February 1929.

Studies were carried out in Haiti in 1927 in an attempt to determine the minimum length of the larval period of *Diaprepes* (*Exophthalmus*) *quadrivittatus*, Ol., as it was thought that the results would be applicable to various allied weevils that are major pests in Porto Rico and the Lesser Antilles, where the larvae burrow into the roots of sugar-cane and other crops and the adults attack the tender leaves of *Citrus*. *D. quadrivittatus* occurs throughout Haiti, but has not been observed to cause appreciable damage to sugar-cane, of which little is grown, though the adults have been seen feeding on *Sesbania sericea* in cane fields. Both *D. quadrivittatus* and *D. abbreviatus* var. *comma*, Boh., were found in 1920 in considerable abundance on *Citrus* in Santo Domingo, and in 1927 the former was noticed in a *Citrus* nursery in Haiti, ovipositing between the leaves. More than 50 per cent. of these eggs were found to be parasitised by *Tetrastichus haitiensis*, Gahan. Eggs collected on 23rd March hatched in 8–10 days. The larvae soon drop from the leaves and burrow in the soil. In the laboratory they were fed on maize kernels and passed through 15 instars during a period of over 12 months, but did not increase in size or weight after the ninth instar, when they were more than three times as heavy as the adult. None of the larvae survived, the last being accidentally killed on 30th March.

Ewing (H. E.). **A new Variety of** *Tarsonemus* **(Acarina) from the Pacific Coast.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 2, pp. 31–32. Washington, D.C., February 1929.

Tarsonemus approximatus, Banks var. *narcissi*, n., is described from California, where it causes some injury to narcissus plants and bulbs, penetrating into the latter between the fleshy scales. This mite is often accompanied by a predacious Gamasid.

Aldrich (J. M.). **Notes on the Synonymy of Diptera, No. 3.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 2, pp. 32–36. Washington, D.C., February 1929.

The Diptera dealt with include *Paratheresia signifera*, Towns., which was originally reared by Rosenfeld and Barber at Tucumán, Argentina, in 1911–13 from *Diatraea saccharalis*, F. (sugar-cane moth borer) and discussed by them without being given a name. The species was meanwhile described by Townsend in 1920 from a single female, which he found on the trunk of a tree in Peru, and the fly has since been recorded from *D. saccharalis* in Peru, Honduras and Mexico. In 1926 Brèthes, when asked to ascertain the identity of the parasites reared by Rosenfeld and Barber, described the same species as *Sarcophaga diatraeae* [*R.A.E.*, A, xvi, 159]. It thus appears to be a not uncommon parasite of *D. saccharalis* throughout the sugar-growing region of North and South America.

Dyar (H. G.) & Heinrich (C.). **A new Species of *Acrobasis* (Lepidoptera : Pyralidae : Phycitinae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 2, pp. 37–38, 1 pl. Washington, D.C., February 1929.

Acrobasis cunulae, sp. n., is described from Alabama and Georgia, where it is injurious to pecan.

Bridwell (J. C.). **The Cowpea Bruchid (Coleoptera) under another Name.—A Plea for one Kind of Entomological Specialist.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 2, pp. 39–44. Washington, D.C., February 1929.

Examination of the description of a Bruchid recorded by M. H. Caillol from Timbuctoo as *Acanthoscelides trabuti*, a new species occurring in the seeds of cowpeas (*Vigna sinensis*) [*R.A.E.*, A, vii, 236], shows it to be identical with the cowpea Bruchid, the synonymy of which is discussed. The author considers the correct name for this Bruchid to be *Callosobruchus maculatus*, F. (*quadrimaculatus*, F.), *Callosobruchus* being a subgenus erected by Pic in 1902 (of which *Bruchus chinensis*, L. (*scutellaris*, F.) is here designated as the type). He also discusses the confusion existing in the classification of the genera of the Bruchids.

Whitcomb (W. D.) & Guba (E. F.). **Control of Red Spider and Powdery Mildew on Greenhouse Cucumbers.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 246, pp. 280–294, 3 figs., 1 ref. Amherst, Mass., October 1928.

Although satisfactory treatments have been devised for controlling *Tetranychus telarius*, L. (red spider) and powdery mildew, both of which cause heavy loss in yield and quality to cucumbers in greenhouses, the materials hitherto used cannot be combined or used in rapid sequence with safety. This paper suggests a proper choice of materials for a

combination treatment and indicates methods of greenhouse management that tend to check the damage. Repressive measures include treatment of greenhouses previous to setting up a new crop by means of burning sulphur at the rate of $\frac{1}{3}$ lb. to 1,000 cu. ft., or fumigation with calcium cyanide at the rate of $\frac{1}{4}$–$\frac{1}{2}$ lb., or with naphthalene melted and vaporised over lamps, etc., at a temperature continuously maintained at 75° F., at the rate of 1 lb. to 1,000 cu. ft. Sulphur is the only one of these materials that affects mildew, but is slightly less effective against red spider than the others. Young plants should be examined and treated where necessary before transplanting. Any possible foodplants of red spider present in the greenhouse should be examined at regular intervals and treated, and the surrounding ground kept free from plants likely to harbour pests of cucumber.

Among various partly effective treatments employed against *Tetranychus*, sulphur sprays fail to kill the eggs and have little effect on the transforming stages. Dusting is not effective because of the difficulty of reaching the lower surfaces of the leaves where the mites congregate. The most effective and satisfactory spray is a highly refined white mineral oil emulsion, one application of which will kill from 95 to 100 per cent. of the mites and prevent the development of a large percentage of the eggs, two thorough applications securing complete control. When applied at the rate of 1 gal. emulsion to 99 gals. water, this spray does not injure the vines, unless the temperature is 95° F. or higher, when scorching or gradual hardening of the older leaves may result. If cucumber vines are sprayed twice before they are 7–8 ft. high, little injury from red spider will follow, but where later spraying is necessary, two further applications should be made at an interval of a week. The diluted spray costs from $1\frac{1}{2}d.$ to $3d.$ per U.S. gal. Although fumigation with vaporised naphthalene at the rate of $1\frac{1}{2}$ to 4 oz. crystals to 1,000 cu. ft. was effective in 3 or 4 treatments in controlling red spider, it is not recommended, as the cucumbers absorb the odour and taste of the fumigant.

As copper sulphate sprays used against powdery mildew leave a residue on the leaves, which causes severe scorching of cucumber foliage when reacted upon by hydrocyanic acid gas generated from sodium or calcium cyanide, fumigation with this gas should always be carried out before spraying with copper fungicides, or nicotine fumes or sprays should be used instead. When Aphids or thrips are present in conjunction with red spider, the addition of 1 pint of 40 per cent. nicotine sulphate or 40 per cent. free nicotine liquid in 100 gals. of diluted white oil emulsion will control all these pests, and if mildew is present, Bordeaux mixture or other copper sulphate sprays may safely be mixed with the oil-nicotine or with the oil spray. This combination spray may conveniently be mixed by adding the oil emulsion to the diluted copper spray. Although the use of a highly refined oil emulsion in the presence of residues from high grade sulphur dust has hitherto caused severe injury to the foliage, especially in warm weather, it has been found that dusts with a low free sulphur content may safely be used either before or after the oil spray when both red spider and mildew are present, a sulphur content of 10 per cent. or less being sufficient to control the fungus when the weather is bright and warm. In milder weather dusts containing 15–20 per cent. free sulphur have given good control without injury. In cool damp weather, when the dusts are less effective, a copper fungicide may be applied in combination with the oil emulsion.

Burke (H. E.). **The Pacific Flathead Borer.**—*Tech. Bull. U.S. Dept. Agric.*, no. 83, 36 pp., 12 figs., 38 refs. Washington, D.C., January 1929.

The Buprestid, *Chrysobothris mali*, Horn, a brief account of which has already been noticed [*R.A.E.*, A, vii, 475], is one of the most important pests of deciduous shade trees and ornamental trees and shrubs on the Pacific coast, particularly in nurseries and immediately after transplantation. It also seriously injures some of the more valuable fruit trees. Its distribution is given, together with a list of at least 70 species of food-plants on which it has been taken, though it will probably be found to attack practically all deciduous fruit and shade trees. Descriptions of all stages of the insect are given, including Horn's description of the adults, with revisional notes, and a detailed description of the mature larva prepared by A. G. Böving. The characters distinguishing the various stages from those of *C. femorata*, F., are also given.

The larva practically always mines in the cambium until fully grown, when it bores directly into the wood and forms a cell in which it pupates [*cf. loc. cit.*]. The mines wind about and sometimes girdle branches or the trunks of small trees; in roses, blackberries and similar plants the mines and pupal cells often occur in the pith. Some larvae enter the prepupal stage in the middle of August, but most of them do so in September and October. Some remain as prepupae until the following June, and at higher altitudes until the end of July. A few individuals overwinter as feeding larvae in the mines, but no pupae or young adults have been found in the cells during the winter. Pupation begins about the middle of March and continues until the middle of June, the majority pupating between 15th April and 15th May. Transformation to the adult stage generally takes place from about 1st April to the middle of July. Observations indicate that there is one generation a year at lower and medium altitudes, but that in some cases at higher altitudes there may be only two generations in three years.

The natural enemies of *C. mali*, which include birds, do not appear to be of much value in its control. Mites seem to be the most important predators; in one case many of the larvae attacking currants were infested by *Pediculoides ventricosus*, Newp. Two Braconids, one Evaniid, one Ichneumonid, one Tetrastichid and one Chalcid have been observed feeding on the larvae, of which the Chalcid, *Trigonura californica*, Roh., is the most important. Notes are given on other boring beetles found in association with *C. mali*.

Various measures of control are discussed, and the following recommendations are made for central California as a result of numerous observations and experiments. The trunks of all transplanted trees should be shaded for the first three or four years with some sort of mechanical protector, of which the best is made from the flowering stem of *Yucca whipplei*, as the females appear to seek trees with trunks exposed to bright sunshine for oviposition. The protector should cover the trunk below the lower branches and have its lower end forced into the soil for at least an inch. If a tree is attacked, the young larvae should be cut out before they have caused serious injury, all trees being carefully examined in the middle of June, again in the middle of July and finally about the end of August. Wounds made in carrying out this treatment should be covered with tree paint

or grafting wax. All possible breeding-places in or near orchards should be eliminated. The repellents, poisoned washes, ovicides and larvicides so far developed cannot be depended on to reduce an infestation sufficiently to allow the other measures advocated to be discontinued.

HOUGH (W. S.). **The delayed dormant Spray.**—*Proc. 33rd Ann. Mtg. Virginia State Hort. Soc. 1928*, pp. 129–133. Staunton, Va., 1929.

The author points out the importance of applying a delayed dormant spray in apple orchards in Virginia even though the scale-insects and Aphids against which it is directed are not at that time visible in large numbers. From the time the leaves drop in the autumn until they are an inch long in spring, the overwintering scales are only partly grown and are more easily controlled than at any other time of year. On the other hand, the Aphid eggs on the twigs are largely immune from injury, and spraying must therefore be delayed until the buds are breaking in late March or early April. The periods during which such sprays could be applied in orchards with standard commercial varieties of apple in northern Virginia for the past seven years varied from 8–21 weekdays, but taking into account interference due to bad weather, it is not safe to count on more than about 6 days favourable for spraying. The delayed dormant period for individual varieties may be less than for the entire orchard, and varieties developing earlier should be sprayed first, particularly as the period is usually shorter for this type of tree.

With regard to the type of oil for use against scale-insects, it was found that a 3 per cent. emulsion of a more highly refined heavier oil with a viscosity of 224 or 250 was more effective against San José scale [*Aspidiotus perniciosus*, Comst.] than a 4 per cent. emulsion of a less expensive light lubricating oil with a viscosity of 70, lime-sulphur (4·6° Bé.), or a proprietary oil emulsion at the rate of 2 gals. to 100. Dry lime-sulphur used at the rate of 24 and 30 lb. powder in 100 U.S. gals. water did not give satisfactory results, and oil emulsions at the proper strength gave better results than lime-sulphur at the rate of $12\frac{1}{2}$ gals. to 100 gals. water.

The oil sprays were emulsified either with casein or with potash fish-oil soap and cresol, both being made by stirring the materials cold. The soap-cresol emulsion is more permanent, because the oil globules are much smaller and remain in suspension longer, whereas the larger globules of the casein emulsion soon separate from the water when diluted in the spray tank. When the diluted emulsions are sprayed on the trees, the extremely fine oil particles of the more permanent type of emulsion remain mixed with the water and run off with the drip, whereas the larger particles tend to separate from the water when the spray hits the tree, with the result that the drip is mainly water and more of the oil remains on the tree. In the miscible oil sprays on the market, the oil particles are extremely small, so that much oil is lost in the drip, and it is therefore necessary to use a higher percentage of oil in the diluted spray. Most miscible oils when diluted should not contain less than 5 per cent. of oil, whereas the less permanent types of oil sprays or quick-breaking emulsions are effective at strengths of 3 and 4 per cent. oil. In some home-made oil emulsions diluted in the spray tank, separation takes place so quickly that a large proportion

of the oil goes to the top of the tank before the contents of the tank have been sprayed on to the trees, particularly where the distance between the place of filling and the place of spraying is great, with the result that most of the trees receive much less oil than is necessary and the last trees sprayed receive much more oil than they need.

Owing to its erratic appearance, the rosy apple aphis [*Aphis roseus*, Baker (*malifoliae*, auct.)] is the most difficult insect to control in orchards in Virginia, but as it causes considerable damage, it is advisable to assume that an outbreak will occur. One difficulty in depending on oil sprays against it is that it is usually the last of the three common apple Aphids [*R.A.E.*, A, ix, 571] to hatch, although some individuals can be found during the early part of the delayed dormant spray period. As a rule lime-sulphur in combination with nicotine sulphate, applied from the time when the buds are showing a considerable amount of green in the tips until the first leaves are an inch long, will give satisfactory results. Winter strength lime-sulphur cannot, however, be applied with safety after the first leaves are more than about ¾ in. long, so that the period when this combination of materials can be used for the control of both scale-insects and Aphids is short, sometimes about half as long as the delayed dormant spray period. Summer strength lime-sulphur with nicotine sulphate gives excellent results against the Aphids, so long as they are not protected by the leaves, which tend to curl after they are more than an inch long.

CAGLE (L. R.). **The Oriental Fruit Moth.**—*Proc. 33rd Ann. Mtg. Virginia State Hort. Soc. 1928*, pp. 133–136. Staunton, Va., 1929.

The economic status of the Oriental fruit moth [*Cydia molesta*, Busck] on peaches in Virginia is discussed, and its life-history is very briefly outlined. The larvae of the first and second generations and of the early part of the third generation live almost entirely in the twigs, whereas those of the last part of the third and the whole of the fourth generation attack the fruit. The fifth generation is small and of little importance, owing to the lack of fruit in which to feed. Less than 10 per cent. of the third brood larvae overwinter, but 90 per cent. of the fourth brood larvae hibernate. Varieties ripening later than the time of occurrence of the last of the third brood caterpillars should be avoided, in order that the larvae of the fourth brood and consequently a large percentage of the overwintering individuals may be eliminated through lack of suitable food, the twigs at this time being so hard that few larvae can reach maturity in them. Packing houses are important centres of infestation, and an account is given of an infestation that was almost certainly derived from one. Since control measures are at present being directed towards a reduction in the numbers of overwintering larvae, which hibernate in cracks in the bark, in rubbish on the ground, in packing houses, on picking baskets, etc., the following measures are recommended: thorough cultivation of the orchard, especially beneath the trees, before 1st April in the southern part of the State and 10th April in the northern part; the use of paradichlorobenzene at the usual time for the peach tree borer [*Aegeria exitiosa*, Say] to kill larvae that are often found in cocoons at the base of the trunk; the removal and destruction of fallen fruit and the immediate disposal of discarded peaches; the screening of the packing

house, or at least that part where the discarded fruit is allowed to remain for even a short time, so that it can be closed during the emergence of the spring brood of moths, that is until about 15th June ; and the storage of picking baskets during the winter in the screened portion of the packing house until after the spring emergence.

ROARK (R. C.). **Review of United States Patents relating to Pest Control.**—i, nos. 7–12 ; 21, 23, 11, 14, 11, 14 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1928.

Abstracts of patents relating to insecticides, etc., issued from the beginning of July to the end of December 1928 are given [*cf. R.A.E.*, A, xvi, 646].

KEEN (F. P.). **Insect Enemies of California Pines and their Control.**—*Bull. Div. For. Dept. Nat. Resources Cal.*, no. 7, 113 pp., 51 figs., refs. Sacramento, Cal., 1929.

This bulletin has been compiled to give as complete an account as possible of the insects attacking pines in California and their control. Much of the information has been previously issued in other publications, most of which are not readily accessible, but a great deal of new material has been added to bring the information up to date and to include the results of recent investigations.

The descriptions of the insects and their work are grouped as far as possible according to the natural relationships of the insects, and the groups are arranged in the order of their importance in the forest. The economic status of forest pests is discussed, together with the types of injury they cause and the factors exerting natural control. Various methods of artificial control are described. The appendix includes a table for the diagnosis of primary insect injury, a key for the field identification of the more destructive pests based on the character of the injury caused, and a list showing the insects that attack the various species of pine.

[**Insect Pests in Idaho in 1927.**]—*Bull. Idaho Agric. Expt. Sta.*, no. 160, pp. 21–23. Moscow, Ida., January 1928.

Injury by the codling moth [*Cydia pomonella*, L.] was less severe than in 1926. The most satisfactory control was obtained with lead arsenate at the rate of 3 lb. to 100 U.S. gals. Nicotine in combination with soap was much less effective than in combination with ½ per cent. oil emulsion, the highest percentage of fruit free from stings being obtained with the latter combination. No injury was caused to fruit or foliage by repeated applications of highly refined oils, and as good control was obtained with oils of high viscosity and low concentrations as with oils of lower viscosity and high concentrations. The best results with oils alone were slightly inferior to those obtained with lead arsenate alone, and there were many instances of unsatisfactory control with high grades of oil. On the average, emulsions made with a soap-cresol emulsifier gave slightly better results than those made with

casein-lime. The smaller the amount of casein-lime used the more toxic the emulsion. Lead arsenate sprays alone produced a greater percentage of sound fruit than when one or two cover sprays of lead arsenate were followed by two or three cover sprays of oil.

Oils of higher unsulphonated residue and lower viscosity were more toxic to the eggs of the fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.] within certain limits. Sprays of 7 per cent. actual oil killed an average of 99·37 per cent. of the eggs; those of 4 per cent. oil killed 95·80 per cent. On the average casein-lime produced a more toxic emulsion than soap-cresol in all proportions tried, and decreasing the amount of casein-lime used to emulsify a certain amount of oil increased its killing properties. These results indicate that practical control of this pest may be obtained by the use of 4 per cent. oil thoroughly applied.

Oil sprays for the control of blister mites [*Eriophyes pyri*, Pgst.] on apples were much less effective than lime-sulphur, but in many cases gave very satisfactory results. Where a combination of oil and lime-sulphur was used, an average of nearly 100 per cent. control was obtained. Tests with oils as dormant sprays for San José scale [*Aspidiotus perniciosus*, Comst.] showed that 3 per cent. actual oil was as effective on heavily infested trees as 4 per cent., if thoroughly applied. It appears that 4 per cent. oil will give commercial control of *A. perniciosus*, *E. pyri* and *T. argyrospila* in southern Idaho, where all three pests have to be controlled at the same time.

Baiting and subsequent fumigation with calcium cyanide did not prove very effective against wireworms, which continue to cause heavy annual losses.

Entomological Branch.—*Reps. Minist. Agric. Canada 1926–27, 1927–28*, pp. 105–123, 105–126. Ottawa, 1927 & 1928.

A summary is given of the outbreaks of the various injurious insects that occurred in Canada in 1926 and 1927, the more important of which have already been noticed in greater detail from other sources. The work undertaken by the different Divisions of the Department of Agriculture in connection with quarantines and the control of insect pests is briefly reviewed.

Downes (W.). **Notes on Economic Insects on Vancouver Island in 1927.**—*Proc. Ent. Soc. Br. Columbia 1928*, no. 25, pp. 16–18. [Agassiz, B.C., 1929.]

Owing to weather conditions no severe outbreaks of insect pests occurred on Vancouver Island during 1927. *Cydia* (*Grapholitha*) *packardi*, Zell. (cherry fruit worm) caused considerable damage to sour cherries; in some cases as much as 30 per cent. of the crop has been lost each year for the past three years. Eggs are laid singly on the fruit in early June and the larvae feed inside, round the stone. They mature before the fruit is ready for picking in July and seek shelter for the autumn and winter in the centres of dead cherry twigs or bracken stems or in crevices in the bark. Pupation takes place in the following spring, and the adults emerge in May. *Depressaria heracleana*, DeG. (parsnip webworm) appeared in large numbers and caused considerable injury in gardens by boring into the leaf-stems

of parsnips. It was also found abundantly in the stems of hemlock and wild parsnip. Young pines in a nursery were found to be heavily infested with *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (pine shoot moth). *Forficula auricularia*, L. (European earwig) continued to spread and was found in several new localities. Another species of earwig, *Anisolabis* (*Euborellia*) *annulipes*, Lucas, was found to be established in gardens in Victoria. Its habits appear to be similar to those of *F. auricularia*, but whether it is capable of being equally destructive is not known. *Gracilaria syringella*, F. (lilac leaf-miner) has now spread all over the city of Victoria and has also been found at Sidney.

GLENDENNING (R.). **An interesting *Myzocallis* (Hemiptera, Aphididae).** —*Proc. Ent. Soc. Br. Columbia 1928*, no. 25, pp. 18–20. [Agassiz, B.C., 1929.]

Myzocallis alni, DeG., was taken in 1926 on native alder (*Alnus oregona*) and on wild strawberry (*Fragaria glauca*) growing in close proximity at Agassiz, B.C. In experiments it was found impossible to maintain individuals transferred from alder on potted wild strawberry plants for more than a day or two, and although the Aphids would often migrate voluntarily from potted alders placed close to the strawberry plants in the insectary, and would even feed readily, they would not remain there for any length of time. This species appears to be native to British Columbia, being widely spread and abundant annually on alders in the lower Fraser Valley. Both adults and nymphs have been often found on strawberries when these plants are growing near alders, but not otherwise, and no infestation has been found on other herbs or grasses growing in the vicinity, although in England it has been found on thyme (*Thymus serpyllum*) and a species of *Epilobium*, when growing under alders. The author is inclined to the theory that this habit of casual migration is the first step in the acquisition of a regular secondary food-plant habit.

SPENCER (G. J.). **The Cabbage Root Maggot (*Hylemyia brassicae* Bouché) attacking Carnations.**—*Proc. Ent. Soc. Br. Columbia 1928*, no. 25, pp. 21–23, 1 fig. [Agassiz, B.C., 1929.]

In February 1927 considerable damage was caused to the stems and roots of carnation cuttings in British Columbia by a fly that was at first thought to be *Phorbia* (*Hylemyia*) *brassicae*, Bch. (cabbage root maggot), but is now considered to be *Hylemyia brunnescens*, Zett., which is a common pest of carnations in England but has not previously been recorded in Canada. All the infested stock was destroyed, and the fly has not since been observed.

MURILLO (L. M.). **El pulgón lanígero.** [The Woolly Aphis.]—*Rev. Industrias*, v, no. 55, pp. 207–210, 4 figs., 6 refs. Bogotá, December 1928.

A short account is given of the bionomics of the woolly apple aphis, *Eriosoma lanigerum*, Hausm., in Europe and North America, as although it has occurred in Colombia for a considerable time, no observations have been made on it there.

Wolcott (G. N.). **Plagas de insectos en el Valle de Chanchamayo y zonas vecinas. Forma de propagación del Arrebiatado en Piura. Estudio sobre los barrenos de la caña en Chiclayo y Trujillo.** [Insect Pests in the Chanchamayo Valley and neighbouring Districts. The Method of Spread of *Dysdercus ruficollis* in Piura. Study on the Cane Borers in Chiclayo and Trujillo.]—*Informe Estac. exp. agric. Soc. nac. agrar.*, no. 8, 15 pp., 6 figs. Lima, November 1928.

Wolcott (G. N.). **La Hormiga " Coqui " en Chanchamayo. Notas sobre el Arrebiatado en el Norte.** [The Parasol Ant, *Atta* sp., in Chanchamayo. Notes on *Dysdercus ruficollis* in North Peru.]—*La Vida agríc.*, vi, no. 61, pp. 11–15, 1 fig. Lima, January 1929.

Insect pests observed in September 1928 in or near the Chanchamayo valley, Peru, included froghoppers, *Tomaspis* sp., and the weevils, *Metamasius anceps*, Gyll., and *M. hemipterus*, L., on sugar-cane, the last two, however, being only secondary pests. A leaf-cutting ant, *Atta* sp., causes great damage to *Citrus* and avocado.

In certain valleys in North Peru the cotton stainer, *Dysdercus ruficollis*, L., has been found on *Bombax discolor* and *Cochlospermum* sp., which bear pods containing a silky fibre attractive to it. It is possible that it migrates from these trees to wild cotton and so to the cotton fields, but no data exist for assuming that migration occurs to distances greater than that between one field of cotton and another.

Fields of young sugar-cane planted in the cold season suffer little from the moth borer, *Diatraea saccharalis*, F., as compared with those of similar age planted in hot weather. In the case of ratoon cane, dead shoots are caused by a smaller caterpillar distinct from *D. saccharalis*. As the injury is limited to quite young cane, any measures accelerating growth will be useful.

Poppe (J. B.). **Notas sobre el " Arrebiatado " en Piura.** [Notes on *Dysdercus ruficollis* in Piura.]—*La Vida agríc.*, vi, no. 61, p. 16. Lima, January 1929.

In the Piura valley, Peru, cotton plants infested by the cotton-stainer [*Dysdercus ruficollis*, L.] produced 33 per cent. of stained cotton. In plants protected by covers only 5 per cent. of the cotton was stained. The bugs seem to breed in greater numbers from September to November than from June to August; a high degree of humidity is unfavourable to reproduction. Hand-collection gave fair results from May to July. Dates for sowing cotton in various localities so that the crop may be harvested when the bugs are at their minimum are indicated. All cotton plants should be destroyed immediately after the harvest.

Bondar (G.). **Gorgulho.** *Sternechus uncipennis* **Boh. nas vagens de** *Canavalia*. [The Weevil, *S. uncipennis*, in Pods of *Canavalia*.]—*Correio agric.*, vi, no. 10, pp. 219–220. Bahia, October 1928.

Sternechus uncipennis, Boh., infests wild species of *Canavalia* in Bahia, and attention is drawn to it owing to the likelihood of its passing to *C. ensiformis*. At night, and by day during cloudy weather, the weevils feed in the green pods and oviposit in the pulp surrounding

the seeds. Usually two eggs are laid in a pod. The larvae feed for about a month and then rest in the ground prior to pupation. The complete cycle may last from six months to a year.

Bondar (G.). **Amarellecimento das folhas do feijão causado pelo Tingitideo** *Gargaphia torrezi*, **Costa Lima.** [Yellowing of the Leaves of Beans caused by the Tingid, *G. torrezi*.]—*Correio agric.*, vi, no. 11–12, pp. 244–247, 3 figs. Bahia, November–December 1928.

The Tingid, *Gargaphia torrezi*, Costa Lima, which has already been recorded from cotton in Brazil [*R.A.E.*, A, x, 273], also infests beans (*Phaseolus*), ovipositing on the lower surface of the leaves, where the larvae feed. A spray of 3 per cent. carbolineum is recommended.

Bondar (G.). **Uma provação da lavoura cafeeira na Bahia.** [A Pest of Coffee in Bahia.]—*Correio agric.*, vi, no. 11–12, pp. 252–256. Bahia, November–December 1928.

At Lagôa Nova in Bahia a black ant, *Campanotus fastigans*, has invaded the coffee plantations, preventing work being done there and destroying the bushes by stripping the roots of their bark. It also fosters *Pseudococcus* sp. on the roots, *Coccus viridis*, *Ichnaspis longirostris* and *Aleurothrixus floccosus* on the leaves, *Pseudococcus citri* on the fruits, and *Saissetia coffeae* (*Lecanium hemisphaericum*) on the branches and stems. It is associated with the following species on the trees interplanted with coffee: *A. floccosus*, *Paraleurodes crateraformans* and *Toxoptera aurantii* on orange; various Coccids and the Membracid, *Aethalion reticulatum*, on *Anona*; *Aleurothrixus aipim* on manioc; and *Aethalion reticulatum* on *Cajanus indicus*. In one case, of some 60,000 coffee bushes only about 10 per cent. remain, and even these are in bad condition. Experiments have been made with a large number of insecticides, but an essential preliminary is the clearance of all the interplanted infested trees.

Bondar (G.). **As pragas de café em Pernambuco.** [Coffee Pests in Pernambuco.]—*Correio agric.*, vi, no. 11–12, p. 256. Bahia, November–December 1928.

Coccus viridis, Green, has been observed attacking about 10,000 coffee bushes in Pernambuco, those 2 or 3 years old being chiefly infested. A 3–4 per cent. solution of soluble carbolineum is recommended. *Leucoptera coffeella*, Guér., which mines the leaves, also occurs.

da Costa Lima (A.). **Sobre alguns cryphalineos observados em sementes de cacaoeiro e de cafeeiro.** [Some Cryphaline Beetles observed in Cacao and Coffee Beans.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 4, pp. 117–123, 4 figs., 3 pls., 7 refs. Rio de Janeiro, December 1928.

This paper deals with three Scolytids obtained in Bahia from cacao and coffee beans, *viz.*, *Hypothenemus* sp., apparently *H. hispidulus*, Lec., *Stephanoderes* (*H.*) *heterolepis*, sp. n., and *S. seriatus*, Eichhoff. The author considers that *Stephanoderes* is not generically distinct from *Hypothenemus*, and regards *S. seriatus* as a synonym of *S.* (*H.*) *plumeriae*, Noerdl.

DA COSTA LIMA (A.). **Contribuição ao estudo dos aleyrodideos da subfamilia Aleurodicinae.** [A Contribution to the Study of the Aleurodids of the Subfamily Aleurodicinae.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 4, pp. 128–140, 9 figs., 4 pls., 7 refs. Rio de Janeiro, December 1928.

The species dealt with, all of which are from Brazil, include *Aleurodicus bondari*, sp. n., on orange; *A. maritimus*, Hempel (*linguosus*, Bondar), on *Cajanus indicus*; *Paraleurodes goyabae*, Goeldi, on guava, mulberry and sapodilla; *P. citricolus*, sp. n., on orange; and *Ceraleurodicus moreirai*, sp. n., on custard apple (*Anona squamosa*).

BONDAR (G.). **Aleyrodideos do Brasil (2a. contribuição).**—*Bol. Lab. Path. veg.*, no. 5, 37 pp., 19 figs. Bahia, 1928.

This is a supplement to the author's monograph on the Aleurodids of Brazil [*R.A.E.*, A, xi, 491]. Of the 19 species dealt with, 17 are new, including *Bemisia bahiana*, sp. n., and *Trialeurodes tabaci*, sp. n., on tobacco.

THEOBALD (F. V.). **The Plant Lice or Aphididae of Great Britain. Vol. iii.**—Demy 8vo, vi+364 pp., 213 figs. London and Ashford, Kent, Headley Bros., 1929. Price 30*s*.

This concluding volume of the author's monograph of British Aphids [*R.A.E.*, A, xiv, 342; xvi, 110] deals with the remainder of the APHIDINAE, comprising part of the CALLIPTERINI, the VACUNINI and the LACHNINI, and with the ERIOSOMATINAE, HORMAPHIDINAE and MINDARINAE, and includes an appendix to all three volumes, containing additional notes and descriptions.

Species attacking economic plants include *Pemphigus pseudoauriculae*, sp. n., on roots of auricula; *P. rubiradicis*, sp. n., on roots of raspberry; *Myzus quasipyrinus*, sp. n., which curls the leaves, *Aphis watsoni*, sp. n., and *Anuraphis pyriella*, sp. n., on pear; *Anoecia corni*, F., which attacks *Cornus*, on which the winter eggs are laid, and the roots of grasses and other plants, and has recently been found damaging wheat in England; *Cinara* (*Pterochlorus*) *saligna*, Gmel. (*viminalis* Boy.), on willow and apple; *Trifidaphis phaseoli*, Pass. (*perniciosa*, Nevskiĭ), which sometimes does considerable damage to beans, attacking the roots and underground parts of the stems; *Pemphigus auriculae*, Murr. (*eragrostidis*, auct. nec Pass., *Rhizobius graminis*, Buckt.), on roots of auricula and other species of *Primula*, spruce and grasses; and *Aphis pyrastri*, Boisd., on pear, injuring the young shoots and curling the leaves.

The author now considers that *Myzus* (*Aphis*) *solani*, Kalt., (*pseudosolani*, Theo.) is not identical with *Macrosiphum gei*, Koch (*solanifolii*, Ashm.), as has been suggested [*R.A.E.*, A, xiv, 255]; *M. solani* has recently been discovered on foxglove (*Digitalis purpurea*) in Britain, as well as in the United States, where the winter egg has been found on this plant [xvii, 81]. *Neochmosis*, Laing, n. n., is proposed for *Panimerus*, Laing [xv, 166], as *Panimerus* is preoccupied in Diptera; *Aphis abietis*, Wlk., which occurs on spruce, is transferred to this genus.

An account of observations on the life-cycles [on *Acer*] of *Periphyllus testudinatus*, Thornton, and *P. aceris*, Koch, by A. W. Rymer Roberts, is appended.

Massee (A. M.), Steer (W.) & Goodwin (W.). **Further Experiments with Tar Distillate Washes.**—*Ann. Rep. East Malling Res. Sta. 1926 & 1927*, xiv & xv, pt. 2 (suppmt.), pp. 137–150, 1 pl. East Malling, Kent, October 1928.

During 1926 and 1927 further tests with tar distillate washes were carried out on the eggs of *Notolophus antiquus*, L. (vapourer moth), *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) (fruit-tree red spider) and *Malacosoma* (*Clisiocampa*) *neustria*, L. (lackey moth), and on *Eriophyes ribis*, Nal. (black-currant gall-mite).

In 1925 a 5 per cent. concentration of a tar distillate appeared to be more toxic to the eggs of *N. antiquus* than concentrations of 7½ and 10 per cent. [*R.A.E.*, A, xiv, 643]. In order to check this result, the experiment was repeated on a much larger scale. The egg batches used were pinned on thin boards, the edges of which were coated with tree-banding grease to prevent the escape of the larvae when they hatched. The "anthracene oil" standardised wash (known as "Standard B") was again used [*loc. cit.*], and it was found to kill 64 per cent. of the viable eggs at 5 per cent. strength, 72·5 at 7½, and 83 at 10. In view of the close approximation of the figures for the two higher concentrations with those obtained in 1925, it is concluded that the figure then obtained with the 5 per cent. concentration is unlikely to be the true toxic value, and that the figure for 1926 is more correct. One of the proprietary tar distillates used in 1925 was again tested, and gave a mortality of 69 per cent. of the viable eggs. As the wash was used at a concentration of 10 per cent., this result is not regarded as satisfactory.

A comparative trial was carried out with two tar distillate washes, one of which contained 25 per cent. tar acids with low boiling points, boiling at 190–215° C., and the other 25 per cent. tar acids with high boiling points, boiling at 220° C. to over 300° C. (80 per cent. at 300° C.), to ascertain whether the toxicity of a tar distillate wash could be referred to any differences in the tar acid content. Both preparations formed stable emulsions that mixed well with water. Since former experiments had shown that the percentage of eggs normally hatching is subject to considerable variation, each egg batch in this experiment was divided into two, one portion forming part of the unsprayed "control" and the other portion being sprayed. The half batches were pinned on boards (as already described), the two portions of each batch bearing corresponding numbers so that any particular batch could be discarded if the unsprayed portion failed to hatch. As in the two previous experiments the eggs hatched over a period of two months. The eggs were protected from the Scelionid, *Telenomus dalmani*, Ratz., by being enclosed in muslin bags. The percentages of viable eggs killed by the washes were 90 and 94 respectively, the difference in killing power not being sufficiently great to warrant the belief that the preparation containing the high-boiling acids is the more effective under the conditions described. Both washes are, however, regarded as satisfactory ovicides for the eggs of *N. antiquus*.

The "light oil" standardised wash (known as "Standard A") [*loc. cit.*] at a concentration of 10 per cent. killed 93 per cent. of the viable eggs of *N. antiquus*, whereas in the laboratory in 1925 at a strength of 7½ per cent. only 56 per cent. of those of *Phorodon humuli*, Schr. (hop-damson aphis) were killed.

In experiments with a proprietary tar distillate, "Standard A" and "Standard B" washes, and dichlorobenzene, both alone and mixed with "Standard A," against the eggs of *P. pilosus*, the highest percentage of viable eggs killed was only 17 per cent., and this was obtained with the mixture of dichlorobenzene and 10 per cent. "Standard A," a result that is of interest in view of the claims sometimes made that tar distillate washes are toxic to the eggs of red spider.

"Standard A" and "Standard B" at a strength of 10 per cent. used against the eggs of *Malacosoma neustria* killed 56·5 per cent. and 68 per cent. respectively of the viable eggs, and cannot therefore be considered highly toxic. In another experiment carried out in 1925 a number of eggs were soaked for 24 hours in a 10 per cent. strength of a proprietary tar distillate, and three months later more than 90 per cent. of the eggs hatched.

In order to test statements sometimes made that tar distillates were effective in controlling "big bud," black currant cuttings badly infested with "big bud" were sprayed with "Standard A" at 10 per cent. strength on 11th February. Migration of the mites was first noted on 27th March, and since the sprayed and unsprayed cuttings appeared to bear the same number of active mites on their outer bud scales, there was no evidence to suggest that the tar-distillate used as a dormant winter wash is toxic to *Eriophyes ribis*. As this preparation is typical of its class, its behaviour is probably more or less the same as that of other tar distillates. During the winter the mites live inside the buds, where they cannot be reached by the spray. Although tar distillates used during the migratory period are highly toxic to the mites, it is then too late to use them on currants.

LePELLEY (R. H.). **Note on the Use of Tar-distillate Spraying and of Greasebanding against the Woolly Aphis of Apple** (*Eriosoma lanigerum* **Hausm.**).—*Ann. Rep. East Malling Res. Sta. 1926 & 1927*, xiv & xv, pt. 2 (suppmt.), pp. 153–156. East Malling, Kent, October 1928.

Apple trees infested with *Eriosoma lanigerum*, Hausm. (woolly aphis) were sprayed with the tar-distillate wash "Standard B" [see preceding paper], and in some cases grease-bands were also applied to sprayed and unsprayed trees. The results indicate that the efficacy of grease-banding is limited by the fact that *E. lanigerum* can usually overwinter above ground in England, and that it is very difficult to ensure the destruction of all these overwintering Aphids; and by the difficulty of applying the bands in commercial practice (especially on old trees with rough bark) efficiently enough to prevent a small number of the insects from finding their way up between the band and the bark. It is not considered that spraying with tar-distillate for the specific object of controlling *E. lanigerum* would ordinarily be an economical measure, though the fact that it destroys a large proportion of the Aphids hibernating above ground should be taken into account when assessing its general value.

MASSEE (A. M.). **The Black Currant Gall Mite on Red Currants.**—*Ann. Rep. East Malling Res. Sta. 1926 & 1927*, xiv & xv, pt. 2 (suppmt.), pp. 151–152, 1 pl. East Malling, Kent, October 1928.

During the past three years the black-currant gall-mite [*Eriophyes ribis*, Nal.] has become unusually common on red currants, causing the failure of several plantations in various parts of Kent. Typical " big buds " are not produced on red currant, but in cases of severe infestation the buds, particularly those at the base of the bush, tend to swell somewhat. In some varieties a dense growth of buds is produced that do not develop normally. In spring the infested buds may be readily detected, since they remain in a dormant condition. Eggs and mites in all stages are found within the infested buds. During the first or second week of April the mites leave the buds, which eventually dry out, and live freely on the lower surface of the leaves during the spring and summer. Immature stages and eggs are also found on the foliage. In the autumn the mites migrate to the buds and remain inside until the following spring. The susceptibility of various varieties to attack is discussed. Preliminary experiments indicate that it will be possible to control the mite by applying a lime-sulphur spray in the spring as soon as the buds open and the mites are beginning to migrate.

MASSEE (A. M.). **Notes on Insect Pests for the Years 1926-27.**—*Ann. Rep. East Malling Res. Sta. 1926 & 1927*, xiv & xv, pt. 2 (suppmt.), pp. 157–162, 1 pl. East Malling, Kent, October 1928.

Notes on some of the pests discussed in this report have already been noticed [*R.A.E.*, A, xvii, 22, 156]. The occurrence of *Anthonomus cinctus*, Redtb. (apple bud weevil) on apple buds at East Malling in March 1927 is recorded. This weevil has not been observed in the district for 5 years [*R.A.E.*, A, xii, 562], though it seems probable that it has been present in small numbers in the plantation during the intervening period.

Caliroa (*Eriocampa*) *limacina*, Retz. (pear and cherry sawfly) has been common in many parts of Kent, where it is reported to have defoliated several pear and cherry orchards. At East Malling both pears and plums were seriously attacked during July, August and September; the larvae were also observed on the foliage of both sweet and sour cherries, but the attack began too late in the year to cause any appreciable damage. The adults were first seen in the plantation on 30th May, and only one generation was recorded in 1927. The larvae feed on the upper surface of the leaves, leaving the lower surface intact, and are therefore easily controlled by spraying with lead arsenate (4 lb. paste to 100 gals. water), only one thorough application being necessary.

Considerable damage has been caused by the Capsid, *Plesiocoris rugicollis*, Fall., in apple plantations, where it feeds on the foliage and developing fruits. *Lygus pabulinus*, L., which is a serious pest in the Cambridge and Wisbech areas, has also been found in Kent, though it did not cause much damage in 1926 and 1927. The commonest Capsid was *Lygus pratensis*, L., which feeds on the foliage of apple, currant and a great variety of other plants, but is of much less importance than *P. rugicollis*.

In some orchards *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) has become very abundant [*R.A.E.*, A, xv, 484], especially where

tar oil washes have been applied for several years in succession. The winter eggs begin to hatch during the second week in April, and usually continue to hatch for several weeks (in 1927 for about 3 weeks). The mites feed on the foliage within a few hours of hatching and begin to lay their eggs on the under surfaces of the leaves in May. *Eriophyes gracilis*, Nal. (raspberry mite) attacked the buds of young seedling raspberries, dwarfing the canes and causing numerous branchings. Lime-sulphur, 1 : 20, killed a large percentage of the mites, but subsequent observations showed that they were still numerous on the canes, and it would appear that two or possibly three applications are necessary to eradicate them entirely.

MARCHAL (P.). **Rapport phytopathologique pour les années 1926-1927.**—*Ann. Epiphyties*, xiii, no. 6, pp. 383–454, refs. Paris [1928].

The majority of the insect pests recorded in this report as occurring in France during 1926 and 1927 and the work done in connection with their control have been already noticed from various sources.

MARCHAL (P.). **Rapports sommaires sur les travaux dans les laboratoires en 1926 et 1927.**—*Ann. Epiphyties*, xiii, no. 6, pp. 455–499, refs. Paris [1928].

Detailed reports are given of the work done in the laboratories of the entomological stations in France during 1926 and 1927, brief reviews of which have already been noticed [*R.A.E.*, A, xvi, 111, 589].

PUSSARD (R.). **Contribution à l'étude morphologique et biologique de la teigne du lilas** (*Gracilaria syringella* **Fab.**).—*Ann. Epiphyties*, xiv, no. 2, pp. 107–131, 8 figs., 35 refs. Paris, 1928.

During 1924 and 1925 important outbreaks of *Gracilaria syringella*, F., occurred at Rouen, where the larvae were observed on various species of lilac (*Syringa*), privet (*Ligustrum*) and *Fraxinus excelsior*. All stages of the moth are described. In France there are three generations a year. The adults from the overwintering pupae appear at the end of April and reach their maximum numbers in the first three weeks of May at the time that lilac is in flower. The first generation larvae pupate about 15th June, and the resulting moths emerge during the first days of July. The second generation develops during August, and the adults emerge about 20th September. The third generation feeds from towards the end of September into October ; pupation takes place at the end of October, and the adults emerge in the following spring. Eggs are laid in batches of about 5–7 on the lower surface of the leaves, usually along the mid-rib. The larvae hatch in about 10 days, and mine directly into the parenchyma, where they live gregariously for 10–15 days. They then perforate the lower epidermis and drop by a thread on to another leaf, and after cutting the mid-rib in several places, proceed to roll the tip under and fasten it with threads. For 10–15 days the larvae feed within this shelter, leaving only the upper epidermis, and then drop to the ground to pupate in cocoons near

the surface of the soil. Occasionally pupation occurs in cracks in the bark, in holes in walls or rarely on the leaves. The pupal stage of the first and second generations lasts about 15 days. A single Ichneumonid parasite was obtained from individuals reared during 1924 and 1925. Sparrows and the earwig, *Forficula auricularia*, L. [*R.A.E.*, A, xvi, 170] are among the most important predators. The embryonic and larval development is discussed in great detail.

Wiesmann (R.). **Untersuchungen über die Bekämpfung der Kirschbaumkrankheiten in Eiken (Fricktal) im Jahre 1927.** [Investigations on Diseases of the Cherry Tree in Eiken in 1927.]—*Schweiz. landw. Monatshefte*, 1928, no. 6, reprint 8 pp., 8 figs. Bern, 1928.

A series of experiments in spraying some 200 cherry trees against insects and fungi was conducted in Switzerland in 1927. A spray of 1 per cent. lead arsenate and 2 per cent. lime-sulphur, applied shortly after the blossoms had opened, was found entirely successful against *Argyresthia ephippiella*, F., and of considerable value against *Cheimatobia brumata*, L. Good results against the latter were also obtained when the spray was applied some time after blossoming, but this was of no value against *A. ephippiella*.

Heymons (R.), Lengerken (H. v.) & Bayer (M.). **Studien über die Lebenserscheinungen der Silphini (Coleopt.). iii & iv.** [Studies on the Bionomics of Silphini. iii & iv.]—*Z. Morph. Oekol. Tiere*, x, no. 2–3, pp. 330–352, 6 figs., 22 refs; xiv, no. 1, pp. 235–260, 12 figs., 36 refs. Berlin, 1928 & 1929.

A detailed account is given of the biology, ecology and morphology of *Xylodrepa quadripunctata*, L. Unlike *Silpha obscura*, L., but like *Phosphuga atrata*, L. [*R.A.E.*, A, xvi, 58, 59], its diet is exclusively animal, and includes living larvae of Lepidoptera, sawflies, and even Coleoptera, and Aphids. In captivity it readily feeds on meat, but refuses snails and all vegetable food. The larvae in captivity feed on young, smooth, or slightly hairy larvae and on freshly killed insects. They can also be successfully reared on meat. Further observations are necessary to ascertain what insects they attack in nature.

Under experimental conditions, *Blitophaga opaca*, L., fed on all kinds of salad and similar plants, on slices of roots, apple, etc., and on chopped meat. It could apparently support life as long on a meat as on a vegetarian diet, but its egg-production was higher and it throve much better on the latter. The larvae eat both vegetable and animal matter and readily devour dead and unhealthy individuals of their own species. On an exclusively meat diet, they die before pupating. In captivity this beetle lays its eggs in the spring, singly in the soil, in most cases just below the surface. They hatch in 2–6 days. The larval life lasts about 12 days. Pupation takes place in the soil, the prepupal stage lasting about 5 days and the pupal stage about 8. The young beetles, when kept at a sufficiently high temperature, become mature in 3–4 months, but although two generations a year can be obtained in the laboratory, it is unlikely that there is more than one generation in the field in Germany, where the young beetle emerges at the end of June and is not mature before September or October, and the winter temperature would be too low for the successful development of a second brood. The morphology of all stages is described.

Rettich (—). **Das Auftreten schädlicher Forstinsekten in Baden im Jahre 1928.** [The Occurrence of Forest Insect Pests in Baden in 1928.]—*Bad. Bl. angew. Ent.*, ii, no. 6, pp. 313–316. Freiburg i. Br., December 1928.

Notes are given on the occurrence of a number of the more common forest pests. The hibernated pupae of the pine sawfly, *Diprion* (*Lophyrus*) *pini*, L., from the outbreak of 1927 were very slightly parasitised, but the cold, wet spring delayed the emergence of the adults, and the normal dates of April for oviposition and May for the appearance of the larvae were retarded by a month. Owing to the abundance of the larvae in June and July, extensive injury by the larvae of the second (autumn) generation was expected, but on an average 50 per cent. of the pupae of the first generation were parasitised, chiefly by an Ichneumonid. Only a few of the eggs of the second generation produced larvae by mid-September and most of these were found to be parasitised.

Eckstein (K.). **Der Hausbock.** [*Hylotrupes bajulus.*]—*Bad. Bl. angew. Ent.*, ii, no. 6, pp. 317–321. Freiburg i. Br., December 1928.

A brief description of the various stages of *Hylotrupes bajulus*, L. is given. In Germany the adults occur from the end of June until August. The active life of the male lasts about 16 days and that of the female about 8. The eggs are usually deposited in fine cracks in timber and hatch in about 8 days, the larvae at once boring into the wood. The adult has emerged from the pupa by the beginning of the year, but remains for 5–7 months before leaving the mine. *H. bajulus* was originally a forest insect, the larva of which developed in old, dry coniferous timber. Particulars are given of various indoor infestations recorded in the literature. The considerable amount of injury caused by comparatively few larvae is explained by the long development of this beetle, which, as the author has found in breeding experiments, requires from $3\frac{1}{2}$ to 11 years. Tests are now being made of various insecticides for impregnating telegraph poles, etc. In constructional timber all infested portions should be cut out, and all the timber should be soaked with hot carbolineum, this being repeated after 4 weeks.

Wünn (H.). **Bemerkungen über Cocciden.** [Observations on Coccids.] —*Bad. Bl. angew. Ent.*, ii, no. 6, pp. 321–322. Freiburg i. Br., December 1928.

Phenacoccus hystrix, Baer., has been found on vine in Baden, but is not expected to be harmful there, as it has occurred for many year on the Middle Rhine without attaining economic importance.

Tempel (W.). **Zur Futteralmottenbekämpfung.** [Measures against Case-bearer Moths.]—*Die kranke Pflanze*, vi, no. 2, pp. 21–23, 2 figs. Dresden, February 1929.

In recent year in Saxony infestation of fruit trees by the case-bearing larvae of *Coleophora hemerobiella*, Scop., and *C. nigricella*, Steph., seems to have been increasing. In some instances the trees

are defoliated and all the crop lost. The moths are on the wing in June and July, and the larvae hatch in late summer, and after feeding without causing any appreciable damage, hibernate in cases spun on buds, in forks, and on rough bark. In spring they eat into the buds, and also attack the leaves. If the tree is not defoliated, its leaves wither and fall. A 10 per cent. carbolineum spray applied when the buds were swelling killed up to 90 per cent. of the larvae, but would be useless if applied earlier when the larvae are still hibernating. An arsenical spray also gave good results.

Nechleba (A.). **Natürlicher Schutz von Scolytiden-Bruten gegen Raubinsekten.** [Natural Protection of Scolytid Broods against Predacious Insects.]—*Anz. Schädlingsk.*, v, no. 2, pp. 24–26. Berlin, 15th February 1929.

In a previous paper the author considered a decrease of reproductive power to be the reason for the dying down of outbreaks of forest pests [*R.A.E.*, A, xvi, 4] and here discusses a suggestion by Dr. M. Wolff that natural enemies were responsible in the cases cited, a contingency that had already been considered. Careful observations in Czechoslovakia of the larva of *Thanasimus* (*Clerus*) *formicarius*, L., which is supposed to destroy *Myelophilus piniperda*, L., failed to disclose any useful action on its part. The bark-beetle shelters its eggs very thoroughly, and fluid resin provides a protection even more effective than the concealment in bark-cracks of the entrances to the mines. The author suggests that the beetle itself is able to surround the entrance hole with resin, which was found above, as well as below, the hole. This is even more evident with *Dendroctonus micans*, Kug. The occasional occurrence of a predatory insect in the empty mines of Scolytids does not justify the view that it has actually destroyed the brood.

Gómez Menor (J.). **Estudios sobre Cóccidos de España.** [Studies on Spanish Coccids.]—*Eos*, iv, no. 3–4, pp. 339–362, 67 figs. Madrid, 31st December 1928.

Descriptions are given of all stages of *Aonidia pinicola*, Leon., infesting *Pinus sylvestris* and *P. halepensis* in Spain, as well as of four new species and one new genus.

Mencacci (M.). **Nuove esperienze sulla disinfezione delle castagne da esportazione.** [New Experiments on the Disinfestation of Chestnuts for Export.]—*Boll. R. Staz. Pat. veg.*, viii, no. 4, pp. 417–427. Rome, 1928.

In further experiments against *Cydia* (*Laspeyresia*) *splendana*, Hb., and *Curculio* (*Balaninus*) *elephas*, Gyll., in chestnuts intended for export [*cf. R.A.E.*, A, xvi, 471], pure carbon bisulphide at the rate of 55 cc. per cubic metre killed all the larvae of both insects, the fumigation lasting 6 hours in a vacuum of 52 cm. of mercury. With commercial carbon bisulphide, a dose of 83 cc. had to be used for $8\frac{1}{2}$ hours in a vacuum of 46 cm. Pure carbon tetrachloride, 70 cc. per cubic metre in a vacuum of 51 cm., failed to produce a 100 per cent. mortality in 9 hours. Chloroform was ineffective. The efficiency of hydrocyanic acid gas was confirmed, but difficulty was again experienced in freeing

the chestnuts from this gas, so that carbon bisulphide is preferable. Soaking in water for 10 days kills all the larvae and does not interfere with the germinative and keeping quality of the chestnuts, provided that they are well dried after treatment.

CANDURA (G. S.). **Contributo alla conoscenza della Tignola grigia delle provviste alimentari** (*Ephestia kuehniella*, **Zeller**) **e del suo parassita** *Nemeritis canescens*, **Gravenhorst.** [A Contribution to the Knowledge of the Moth infesting Foodstuffs, *E. kühniella*, and of its Parasite, *N. canescens*.]—*Boll. Lab. Zool. Portici*, xxi, pp. 149–214, 13 figs., 152 refs. Portici, 1928.

Historical notes are given on the Pyralid, *Ephestia kühniella*, Zell., with descriptions of all its stages, the details of its biology and control being mostly from the author's observations in Italy. The life-history is discussed in detail. The number of generations a year varies according to the climate, and at Portici from 1 to 5 generations were obtained according to the food given to the larvae. The forms of injury noticed in various food-stuffs are described.

A list is given of the recorded parasites of *E. kühniella*, the Ichneumonid, *Nemeritis canescens*, Grav., being the commonest. Experiments in breeding this parasite were made at Portici. Only one adult is obtained from one host larva, even if several eggs have been laid in it. Fourth instar larvae are preferred for oviposition. Parasitised larvae leave their food a little before reaching full growth. They fail to pupate, unless they are parasitised when they are already well grown, but continue to produce silk over a period of 2–3 months at the end of winter or beginning of spring, and for 2–3 weeks in summer. The parasite takes longer to develop in larvae that have not reached nearly full size when parasitised, and it cannot develop and dies in small ones, which are not parasitised under natural conditions. This Ichneumonid may sometimes be of considerable value in controlling *Ephestia*, but its activities in warehouses are hampered by the need of the adults for sugary liquids. A free entry and exit is therefore necessary, as it appears inadvisable to supply such food inside warehouses.

Preventive measures against *Ephestia* include screening of apertures, abundance of light and ventilation, and cleanliness. Remedial measures include the use of dry heat, and, in suitable materials, fumigation with carbon bisulphide. The author suggests that further work should be done to test the value of low temperatures for combating insects and promoting the keeping quality of foodstuffs.

MALENOTTI (E.). **Esperienze di fumigazioni in Alto Adige.** [Fumigation Experiments in the Province of Alto Adige.]—*L'Italia agric.*, lxvi, no. 1, pp. 37–45, 7 figs. Piacenza, January 1929.

In this province of North Italy, pear and apple trees often reach a height of 24 ft. with an even larger diameter, and whereas a fumigant must fill all the space occupied by a tree, a spray is required to cover little more than the surface as there is little foliage in the interior. Fumigation may therefore be cheaper for small trees and spraying for large ones. The experiments here discussed were made in orchards of small trees and were directed against *Aspidiotus ostreaeformis*,

Curt., on apple and pear, and *Eriosoma lanigerum*, Hausm., on apple. The former is not as a rule dangerous, but *E. lanigerum* is of great importance, its parasite, *Aphelinus mali*, Hald., being ineffective, perhaps because of the cold winters and rainy summers, and the variety of apple largely grown being very susceptible. The water used for irrigation also appears to be a factor. In one locality the trees watered from a river rich in lime salts are only slightly attacked, whereas those watered from one poor in lime salts are always heavily infested.

The fumigation experiments are described in detail. Hydrocyanic acid gas produced by refined sodium cyanide, at the rate of 10 oz. to ¾ pint sulphuric acid and 1 pint water, proved very effective against *A. ostreaeformis*. Pear trees treated in July with 4–5 gm. sodium cyanide per cu. m. space under semi-permeable tents [Sansone system, *R.A.E.*, A, xiv, 569 ; xv, 480] can withstand fumigation for an hour even at such high temperatures as 30–32° C. [86–89·6° F.]. For trees not exceeding 12 ft. in height such fumigation is the cheapest measure against *A. ostreaeformis*. Hydrocyanic acid gas fumigation is not advisable, however, at least in summer, against *E. lanigerum*. The minimum dose of pure cyanide necessary is 6 gm. per cu. m. for 1 hour at temperatures between 22 and 32° C. [71·6 and 89·6° F.]. Though the mortality is marked, entire colonies of the Aphid remain unaffected even with doses of 10–11 gm. *Aphelinus mali* withstands fumigation if still within its host. Vigorous apple trees not infested by the Aphid can resist a dose of 10 gm., but if the trees are much infested their resistance does not extend to the minimum dose needed for the destruction of *E. lanigerum*. Moreover, the erection and removal of the tents in mid-July causes the fall of an appreciable number of apples, which was not the case with pears.

Grandi (G.). *Dorcadion arenarium aemilianum* **Dep. Suoi danni al Granoturco e descrizione della larva.** [*D. arenarium aemilianum*. The Injury it causes to Maize and a Description of the Larva.]—*Boll. Lab. Ent. R. Ist. sup. agrar. Bologna*, i, pp. 33–36, 2 figs. Bologna, 1928.

In May 1927 a field of maize near Bologna was infested by the larvae of a Lamiid, *Dorcadion arenarium*, Scop., race *aemilianum*, Dep. Many of the young plants were withered ; others were actually lying broken on the ground. The larvae attack the collar of the plant. In the laboratory a larva fed for 3½ months on the medullary parenchyma of the stems into which it bored. It pupated on 13th September, and the adult emerged on 3rd October. As the attack was quite localised, no measures were taken. A detailed description of the larva is given.

Goidanich (A.). **Contributi alla conoscenza dell'entomofauna della canapa. I. Prospetto generale.** [Contributions to the Knowledge of the Insect Fauna of Hemp. I. General Survey.]—*Boll. Lab. Ent. R. Ist. sup. agrar. Bologna*, i, pp. 37–64, refs. Bologna, 1928.

This study of insects infesting hemp [*Cannabis sativa*], which is an important crop in the province of Bologna, was begun in 1925. Notes are given on about a hundred species observed by the author or recorded from the literature on hemp in Italy, divided according to the manner

in which they attack the plant, and on their natural enemies. The paper is to be followed by others on the control of the more injurious species.

Pyrausta nubilalis, Hb., is the most dangerous pest of hemp in Italy. The moths from larvae that have hibernated on other plants oviposit on hemp in spring. The larvae bore in April–May into the stems, and reach the adult stage in August. These moths oviposit on various plants, but the eggs laid on hemp are destroyed when the plants are cut and put to macerate. Four endophagous parasites were obtained from larvae of *P. nubilalis* that have not previously been recorded from this host, *viz.*, the Ichneumonids, *Phaeogenes nigridens*, Wesm., and *Pristomerus vulnerator*, Panz., the Braconid, *Microgaster globatus*, L., and a species of *Eulophus*, probably undescribed, which is very common. *M. globatus* is itself parasitised by a Pteromalid, and another Pteromalid, of which as many as 16 individuals have been obtained from a pupa of *P. nubilalis*, is perhaps a parasite of *Phaeogenes nigridens*. The larva of a Phorid, *Megaselia goidanichi*, Schmitz, is saprophagous, occurring in dead larvae and pupae of *P. nubilalis*, but is also possibly a parasite. It is also parasitised by a Pteromalid.

CHEVALIER (L.). **Un papillon nuisible, la méticuleuse, chenille polyphage** (*Phlogophora meticulosa*).—*Bull. Soc. Sci. Seine-et-Oise*, (2) viii, no. 2, pp. 20–22. Versailles, 1927. [Recd. February 1929.]

The larvae of *Brotolomia* (*Phlogophora*) *meticulosa*, L., cause considerable damage in France during autumn and winter to lettuce, cabbage, chrysanthemums, dahlias, geraniums, hops, etc. There are two generations a year, and in captivity the pupal stage lasts 3 months. Pupation occurs in the soil, and both larvae and adults may be found practically throughout the year.

CHEVALIER (L.). **Biologie et manière de vivre de quelques larves de mouches qui minent les feuilles des plantes potagères et d'agrément.** —*Bull. Soc. Sci. Seine-et-Oise*, (2) viii, no. 2, pp. 26–32. Versailles, 1927. [Recd. February 1929.]

Acidia heraclei, L., has two generations a year in France, the larvae occurring in May-June and October-November. It is a serious pest of parsnip and celery and also attacks celeriac, mining in the leaves. Pupation usually takes place in the soil. The larva is parasitised by *Halticoptera smaragdina*, Curt., and *Opius rufipes*, Wsm.

Pegomyia hyoscyami, Panz., and *P. hyoscyami* var. *betae*, Curt., mine in the leaves of beet and spinach, and *P. versicolor*, Mg., in those of sorrel. *Spilographa zoe*, Mg., mines in the leaves of chrysanthemum in October, the adults appearing at the beginning of the following April. *Phytomyza geniculata*, Fall., mines in the leaves of *Cineraria* and *Anthemis*.

CHEVALIER (L.). **Biologie de la mouche de la betterave** (*Pegomyia hyoscyami* **Panz.**).—*Bull. Soc. Sci. Seine-et-Oise*, (2) ix, no. 3, pp. 33–35. Versailles, 1928. [Recd. February 1929.]

Pegomyia hyoscyami, Panz., a pest of beet, also attacks *Hyoscyamus niger* and *Atriplex hortensis*, which is its favourite food-plant. The

larvae mine in the leaves and generally pupate in the soil. There are two generations a year. The eggs of the first hatch in May, and the adults appear in June and July. The larvae of the second generation are very destructive in August, after which they pupate, producing adults in May of the following year. The commonest parasite is the Braconid, *Biosteres wesmaeli*, Hal., which also has at least two generations a year. Other parasites are the Braconid, *Phaenocarpa pegomyiae*, Mrsh., and the Chalcid, *Decatoma betensis*, Decaux.

HOFFMANN (A.). **Note sur un insecte nuisible à l'horticulture, le *Pyrausta nubilalis*.**—*Bull. Soc. Sci. Seine-et-Oise*, (2) ix, no. 4, pp. 43–47. Versailles, 1928. [Recd. February 1929.]

Pyrausta nubilalis, Hb., is recorded as a serious pest of chrysanthemums in France in 1926–27, and a popular account is given of its bionomics, with some suggestions for its control.

GOURDON (G.). **La destruction des insectes nuisibles par les rayons "ultra-violets."**—*Prog. agric. vitic.*, xci, no. 9, pp. 204–207, 1 fig. Montpellier, 3rd March 1929.

Numerous observations and experiments have demonstrated the effectiveness of cathodic rays in destroying injurious insects, and ultra-violet rays have been found to attract both diurnal and nocturnal species. The rays appear to produce in the insects a sensation that is at first agreeable, but which soon becomes dangerous, if not fatal ; in certain cases they are immediately blinded. A trap apparatus for use in vineyards, orchards or fields is described, to which insects are attracted by means of ultra-violet rays, and are either drawn by the suction of an electric fan into a metal basket or fall blinded outside the trap, where they become an easy prey to birds.

MILES (H. W.). **A Review of the present Position with Regard to Soil Insecticides.**—*J. Bath & West & Southern Counties Soc.*, 1928–29, reprint 24 pp., 6 figs., 47 refs. Bath [1929].

A good deal of information on soil insecticides, their efficiency, scope and methods of use, is collated in this paper, and their value in modern agriculture and horticulture is discussed. For general agriculture, naphthalene and certain allied coal-tar products are chiefly used, when they are available in suitable form and at low cost ; they act mainly as repellents. For intensive agriculture and the cultivation of valuable crops, more costly insecticides such as calcium cyanide, calcium cyanamide and possibly green sulphur (a by-product in the production of coal gas) are suggested in addition to repellents. For market gardening and glasshouse horticulture a number of suitable insecticides are discussed. There still remains a need for an insecticide of wide scope, ready availability and low cost, easy of application and unchanged by storage.

ZACHER (F.). **Die Spinnmilben der Rebe.** [The Spinning Mites of Vine.]—*NachrBl. deuts. PflSchDienst.*, ix, no. 2, pp. 11–12. Berlin, February 1929.

Spinning mites are among the important pests of vine in Germany, particularly in the Rhine Palatinate. *Tetranychus telarius*, L.

(*Epitetranychus althaeae*, v. Hanst.) is widely distributed on vines, but *Paratetranychus pilosus*, C. & F., only infests them occasionally. *T. telarius* is probably the most important mite on vine in other countries, though two other species, *T. trinitatis*, Hirst, in Trinidad, and *P. punicae*, Hirst, in South India, have been recorded on this plant.

Schmidt (M.). *Ancylis comptana*, **Froel. (Lep. Tortr.) als Erdbeerwickler in Sachsen.** [*A. comptana* as a Strawberry Leaf-roller in Saxony.]—*Nachr Bl. deuts. PflSchDienst.*, ix, no. 2, pp. 12–13. Berlin, February 1929.

Ancylis comptana, Froel., caused considerable injury to about 40 acres of strawberries in June 1928 in Saxony. In Germany this moth has two generations a year, the larvae appearing in June and September. It is probable that it is the pupae that hibernate [*cf. R.A.E.*, A, xv, 296]. Other pests observed on strawberry on this occasion were *Phyllopertha horticola*, L., attacking the leaves, and the larvae of *Otiorrhynchus ovatus*, L., on the roots.

Kunze (G.). **Geschmacks- und Giftwirkungen des Fluornatriums auf die Honigbiene.** [Taste and Poison Action of Sodium Fluoride on the Honey-bee.]—*Nachr Bl. deuts. PflSchDienst*, ix, no. 2, pp. 13–14. Berlin, February 1929.

The most successful method for combating the beet-fly, *Pegomyia hyoscyami*, Panz., is that of sweetened poison baits of sodium fluoride introduced by Blunck [*R.A.E.*, A, xv, 205, 229]. Complaints by bee-keepers resulted in the experiments here described to ascertain the effect of sodium fluoride on bees. The conclusion is reached that it is sufficiently harmful to bees to be of some importance. There are, however, a number of substances that render baits unpalatable to them without impairing their attractiveness to the beet-fly.

Schander (R.) & Götze (G.). **Erfahrungen über das Auftreten und die Bekämpfung der Rübenfliege im Jahre 1928.** [Experiences on the Occurrence and Control of the Beet-fly in 1928.]—*Zuckerrübenbau*, xi, no. 1, 1929. (Abstract in *Fortschr. Landw.*, iv, no. 6, p. 180. Vienna, 15th March 1929.)

To combat the beet-fly [*Pegomyia hyoscyami*, Panz.] at Landsberg, Prussia, use was made of a poison bait of 176 lb. chaff mixed with 9–10½ gals. of a solution containing 2½ per cent. of sugar and 4 per cent. of sodium fluosilicate, this being the quantity for 1 acre. A little fresh horse-dung was added to attract the flies, and the bait was placed in heaps of about 5½ lb. each.

Sprengel (L.). **Ueber die Lebensgeschichte der Pflaumensägewespe und Versuche zu ihrer Bekämpfung.** [The Life-history of the Plum Sawfly and Experiments in its Control.]—*Der Obst- u. Gemüsebau*, reprint 2 pp., 2 figs. Berlin [? 1928].

Of recent years injury to plums by *Hoplocampa fulvicornis*, Panz., has become serious in the Palatinate. The appearance of the adult sawflies in spring depends on the weather, but is not closely correlated

with the blossoming of the trees. If both sexes emerge simultaneously, pairing occurs without delay, and the females especially are eager to suck moisture from the flowers of various varieties of plum, which they always do before ovipositing. The egg is laid in the base of the calyx-lobes. The growth of the young fruit is not materially checked until the larger part of the kernel has been eaten by the larva, which then leaves it and bores into another fruit. By the time that the larva is full-grown, only part of the kernel of this fruit has been eaten, and the fruit does not fall until some time after the larva has left it to enter the soil.

Measures against the eggs or young larvae do not appear to be feasible. Arsenical sprays, either with or without the addition of sugar and molasses, give good results against the females, owing to their need for liquids prior to oviposition. Bait-traps hung in the trees are ineffective. Against the larvae migrating to fresh fruits, a second spray of either an arsenical or nicotine give satisfactory results; the occurrence of this migration must be carefully watched for.

Knoche (E.). **Schädling, Klima und Bekämpfung. (Beobachtungen während der Nonnenmassenvermehrung in Sachsen, insbesondere im Zittauer Stadtwald, sowie ältere und neuere Versuche.)** [Insect Pest, Climate, and Control. Observations during the Outbreak of the Nun Moth in Saxony, particularly in the Zittauer Stadtwald, and old and recent Experiments.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xvi, no. 4, pp. 705–775, 5 figs., 42 refs. Berlin, 1929.

It is pointed out that climatic conditions not only affect outbreaks of Lepidopterous pests in forests directly, but also indirectly through their food-plants and natural enemies. After describing the direct effects of weather on the pine Lasiocampid [*Dendrolimus pini*, L.], the author suggests that it has a similar influence on the nun moth [*Lymantria monacha*, L.].

The periodic outbreaks of these pests are not due to a lack of natural enemies, as formerly believed, but to climatic conditions. Dry, warm weather accelerates oviposition and the development of the eggs. In the case of *D. pini* cold and wet weather causes many of the caterpillars to hibernate twice. Oviposition, too, is delayed, and the caterpillars are weak, remain on the trees in autumn and are destroyed by the weather. Similar delays in larval and pupal development occur with the nun moth. In Saxony, near Zittau, an outbreak of the latter occurred in 1920-23, and a detailed account is given of its course. Egg-development in 1921 was retarded in high-lying situations, but was finally completed. In the cold, wet year of 1922 up to 8 per cent. of the eggs were infertile at about 350 ft., and at 2,100 ft. they were all infertile, showing that no mating had taken place.

The author failed to find an indirect effect of weather through the food-plant in the case of *D. pini*, but this effect was observed in that of *L. monacha*. The nun-moth larvae always prefer the previous year's needles to young ones. The softer epidermis of pine needles, as compared with those of spruce, allows them to feed earlier on the old needles. For this reason, in cases of moderate infestation, the May shoots of pine are far less exposed to destruction than those of spruce. But as the epidermis of old pine needles is still too hard for the newly hatched caterpillars, an outbreak in pine forests is possible only in years in which the larvae hatch late and the shoots are early, otherwise

most of the larvae die of starvation. In pine, the interval between the hatching of the caterpillars and the appearance of the shoots is far greater than in spruce.

In 1921 up to 32 per cent. of the larvae of *L. monacha* in Zittau were infested by the Tachinid, *Parasetigena sylvestris*, R.-D. (*segregata*, Rond.), but in 1922 the percentage was lower. In 1923 it was also moderate, but polyhedral disease was general. The development of beneficial species is favoured by warm, dry weather and hindered by wet and cold. But the effect of weather is also indirect. Cold, wet weather may bring together the developmental stages of the pest and its parasite and thus benefit the latter, whereas warm, dry weather may separate them by a long interval.

ESCHERICH (K.). **Der Motorverstäuber im Dienste der Forstschädlingsbekämpfung.** [The Motor-driven Duster in Work against Forest Pests.]—*Forstwiss. CBl.*, 1929, no. 1, pp. 1–14, 9 figs., 4 refs. Berlin, 1929.

This account of the use in Germany of a horse-drawn, motor-driven dust gun for combating forest pests includes references to early experiments in that country [*R.A.E.*, A, xiv, 505; xv, 7], the conclusion being that this apparatus is very valuable in dealing with small centres of infestation, thereby suppressing outbreaks in their initial stages.

ESCHERICH (K.). **Das Vorkommen forstschädlicher Insekten in Bayern. I. Bericht: Das Jahr 1927.** [The Occurrence in Bavaria of Insects injurious to Forests. First Report, 1927.]—*Forstwiss. CBl.*, 1929, no. 3, pp. 69–90, 6 figs. Berlin, 1929.

The more important forest pests during the year included *Melolontha*, which, however, occurred in smaller numbers than in the previous flight-year, 1923; *Hylobius abietis*, L., which was more than usually abundant; *Pissodes piniphilus*, Hbst., which was abundant in several places where pines had been weakened by the pine Geometrid, *Bupalus piniarius*, L.; *Myelophilus piniperda*, L., and *M. minor*, Htg., which also occurred in districts infested by *B. piniarius*; *Ips* (*Pityogenes*) *bistridentatus*, Eich., and *Epiblema* (*Grapholitha*) *tedella*, Cl., on spruce; and *Tortrix viridana*, L., on oaks.

Bupalus piniarius occurred throughout the country, especially in the Upper and Rhine Palatinates. Owing to a disease among the caterpillars in the southern Rhine Palatinate in October 1926, the pupae were not very numerous early in 1927, and about 20 per cent. were parasitised, so that the outbreak could be considered over in the summer. In other parts of the Rhine Palatinate heavy infestations were limited in extent, and an increase of *Ichneumon nigritarius*, Grav., early in 1928 appeared to be responsible for ending the outbreak. The pine sawfly, *Diprion* (*Lophyrus*) *pini*, L., was injurious in various places. *Chermes* (*Dreyfusia*) *nüsslini*, Börn., and *C.* (*D.*) *piceae*, Rtzb., infested silver firs [*Abies*], the injury by the former being serious. Another Aphid, *Mindarus abietinus*, Koch, infests the shoots and needles of silver fir just as *C. nüsslini* does, and as some of its stages secrete wax, it may be mistaken for the latter. For the present the planting of silver firs should be done only where it is imperative. If a careful

watch for signs of infestation is maintained in spring, the immediate application of a suitable spray should keep down the infestation, which begins in small foci and spreads slowly.

[**Circulars on Insect Pests and their Control.**]— *Vlugschr. Plantenziektenk. Dienst,* no. 5, 6 pp., 13 figs.; no. 36, 4 pp.; no. 44, 4 pp. Wageningen, 1928.

These popular circulars deal respectively with spraying and dusting apparatus; with red spiders, *Tetranychus telarius,* L. (*Epitetranychus althaeae,* v. Hanst.), *Paratetranychus pilosus,* C. & F., *Bryobia ribis,* Th., and *B. praetiosa,* Koch; and with the thrips, *Heliothrips haemorrhoidalis,* Bch., and *Parthenothrips dracaenae,* Heeg.

[Dovnar-Zapol'skiĭ (D. P.).] **Довнар-Запольский (П. П.). Bestimmungstabellen der Chalastogastrenlarven.** [*In Russian.*]—*Bull. N. Caucas. Plant Prot. Sta.,* Ser. A, no. 12, 47 pp., 44 figs. Rostov-on-Don, 1929.

This is a key to the larvae of the sawflies that occur, or are likely to occur, in European and Asiatic Russia, based on their morphological characters. The larvae are divided into six groups, according to the manner in which they attack their food-plants, and the food-plants of each species are given.

[Grossgeĭm (N.).] **Гроссгейм (Н.). Spring Control of Fruit Weevils by Shaking.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.,* iv, no. 5, pp. 217–222. Kharkov, May 1928.

Experiments in controlling weevils that attack fruit trees by shaking them from the trees on to white wet sheets spread beneath are discussed. The work was done in the Kiev Government in the springs of 1926 and 1927, the species concerned including *Anthonomus pomorum,* L., *Sciaphobus squalidus,* Gyll., and *Rhynchites* spp. Variations in the numbers of the weevils in different months depend largely on meteorological conditions, but all the species were found to occur in maximum numbers in the second half of April. Shaking proved to be a very effective measure, large numbers of weevils as well as other pests being destroyed. Predacious insects and mites are also destroyed, but further experiments should prove whether this loss is important. The work should be done early in the morning or in the evening, and in calm weather, otherwise the weevils may be carried away by the wind. It should be carried out at least every other day throughout the spring.

[Grossgeĭm (N.).] **Гроссгейм (Н.). Adhesive Bands for the Control of Fruit-tree Weevils.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.,* iv, no. 8–9, pp. 364–370, 1 ref. Kharkov, August-September, 1928.

Adhesive bands for controlling weevils attacking fruit trees in the Ukraine should be applied to trees as soon as the snow melts, *i.e.,* before the weevils begin to emerge from hibernation, and should be

placed just below the chief branches so as to be effective against weevils hibernating under the bark of the trunk as well as those that hibernate in the soil. The technique of the method is described in detail, and the value and cost of various brands of adhesives are discussed. The results of experiments in the Kiev Government in the springs of 1926 and 1927 were checked by shaking the weevils from treated and untreated trees every 3 or 7 days, the species being *Sciaphobus squalidus*, Gyll., *Anthonomus pomorum*, L., and *Rhynchites pauxillus*, Germ. The bands appeared to be completely effective against *S. squalidus*, but only prevented about 50 per cent. of the other two species from reaching the crown; taking into consideration the difficulty of controlling these weevils, however, this result is not considered entirely unsatisfactory. *A. pomorum* and *R. pauxillus* are flying species, whereas *S. squalidus* only flies when the temperature exceeds 12° C. [53·6° F.]; and when it emerges from hibernation the temperature is usually lower. Only a few weevils are caught on the bands, the majority turning back as soon as they encounter them, so that the bands act chiefly as barriers.

[Dekhtyarev (N.).] **Дехтярев (Н.). The Organisation of Quarantine Measures against Orchard Pests in the Ukraine.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, iv, no. 8–9, pp. 341–346. Kharkov, August-September, 1928.

The Central Station for Protection of Plants in the Ukraine is at present working at a programme of quarantine regulations to prevent the spread within the Ukraine of insect and other pests that only occur in limited areas and are chiefly distributed by the movement of infested plants, etc. A list is given of the chief pests of fruit trees against which quarantine measures should be adopted, with notes on their local distribution and the character of the injury they cause. These include Coccids, especially *Lepidosaphes ulmi*, L., *Aspidiotus ostreaeformis*, Curt., *Diaspis leperii*, Sign., *Lecanium corni*, Bch., *L.* (*Sphaerolecanium*) *prunastri*, Boy., and *Physokermes coryli*, L.; various Aphids, of which *Eriosoma lanigerum*, Hausm., and *E. lanuginosum*, Htg., are the most important; several species of Psyllids; bark-beetles; moths, *Zeuzera pyrina*, L., and *Tortrix rosana*, L., being especially injurious; Cecidomyiids, among which *Lasioptera rubi*, Schr., can be transported very easily on its food-plant; sawflies, the hibernating stages of which may be transported in lumps of earth on the roots of seedlings; and mites, of which *Tetranychus telarius*, L., *Eriophyes pyri*, Pgst., and *E. malinus*, Nal., are the commonest.

[Bondarev (A.).] **Бондарев (А.). Contribution to the Fauna of Coccidae of Fruit Trees in the District of the Mleev Experimental Station and on their Distribution by the Wind.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, iv, no. 11–12, pp. 522–529, 6 figs. Kharkov, November-December 1928.

The biology of Coccids in general is briefly reviewed, and brief descriptions are given of the species found on fruit trees in the Kiev

government in the summers of 1927 and 1928, with notes on their life-history.

Aspidiotus ostreaeformis, Curt., was very abundant on apples, pears, plums, apricots, cherries, etc. The female lays 30–70 eggs, the period of oviposition and the emergence of the larvae lasting from the middle of July till the middle of August. The larvae hibernate in the second instar; the females have reached the adult stage by the end of April, at which time the males pupate, emerging towards the end of May. Five species of Chalcids and two mites parasitise this Coccid. *Lepidosaphes ulmi*, L., occurred on apples, pears, plums, etc. It hibernates in the egg stage, the number of eggs under a scale varying from 50–100, and the larvae hatch in the second half of May. Reproduction may be either parthenogenetic or sexual, oviposition occurring at the beginning of August.

Lecanium (*Eulecanium*) *bituberculatum*, Targ., which was not numerous, was found on one- and two-year-old shoots of apple, the number of eggs under the scale being 430–1,100. This Coccid also hibernates in the egg stage, and the larvae hatch in the first half of May. They feed on the lower surface of the leaves, but the adult females migrate to the shoots. *L.* (*E.*) *corni*, Bch., was very abundant on small branches of apples, pears, plums, etc. About 3,000 eggs occur under the scale, and the period of hatching lasts from the beginning of June till the end of July. The larvae live on the lower surface of the leaves and in the autumn migrate to the shoots, where they hibernate in the second instar. Several Hymenopterous parasites of this Coccid have been observed, and the larvae of *Anthribus nebulosus*, Küst., feed on eggs. *L.* (*E.*) *persicae*, F., occurred on black currant and pear. The second instar larvae hibernate at the bases of the buds on young shoots, and the males are on the wing by the end of May. About 2,500 eggs occur under the scale. *L.* (*Sphaerolecanium*) *prunastri*, Boy., was very abundant on plums, cherries and apricots. The female lays about 3,000 eggs, oviposition lasting from the second half of June till the middle of August. The larvae usually infest the under side of the branches and prefer cracks in the bark, hibernating in the second instar. The males were observed at the end of May and in the first half of July. This Coccid is parasitised by six species of Chalcids, and the larvae of *Scymnus* (*Pullus*) *subvillosus*, Goeze, destroy the eggs.

Pulvinaria vitis, L., was found in small numbers on pears and vines. The female lays about 1,000 eggs, which hatch in the second half of June. *Phenacoccus aceris*, Sign., sometimes occurs in cracks of the bark of old apple trees, the larvae having been observed in the second half of May.

The possibility of the distribution of Coccids by the wind is discussed in detail. Experiments in which infested branches were exposed to wind blowing in the direction of the uninfested part of the orchard showed that the larvae were transported by the wind to uninfested trees at considerable distances. Further experiments were made with an apparatus consisting of a large cardboard funnel, with the bottom cut off, fixed to a small frame into which a movable sticky slate is placed. A vane turns the funnel in the direction facing the wind, so that small insects are blown into it and stick to the slate; the whole is fixed to a stand. Several of these funnels were used, and some first instar larvae of Coccids were caught. In some instances they were taken at a distance of over 400 yards from the nearest infested trees. It appears, therefore, that Coccids may be easily and rapidly spread by

wind and infest large areas, and studies should be made to determine species of trees that could be planted as screens between and around separate parts of orchards.

[Pyatakova (V.).] **Пятакова (В.). On the Biology of** *Rhamphus pulicarius*, **Hbst.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, iv, no. 11–12, pp. 530–533, 12 figs. Kharkov, November–December 1928.

A detailed discussion is given of the morphology and bionomics of *Rhamphus pulicarius*, Hbst., which was recorded for the first time from the Kiev Government in the summer of 1925, when only 2 or 3 individuals were captured. In 1927 this weevil greatly increased in numbers and caused considerable damage in apple orchards. All stages are fully described. The first adults appeared on 28th May; they were particularly abundant in June and then gradually decreased until in August–September only isolated individuals could be found. The adults and larvae feed on the parenchyma of the leaves, beginning to mine at the edges and gradually passing to the centre; old trees and shady branches are preferred. Oviposition occurs in a cavity made by the female in the parenchyma of the leaf and lasts from about 10th June till the second half of July, in which period a female lays about 23 eggs. The larvae hatch in about 20 days and begin to feed on the inner tissues of the leaves, but after a few days they enter a diapause, which lasts till the end of August. They then resume feeding until about the middle of September, when a second diapause takes place. In October the larvae begin to feed again and by the time that the cold weather sets in, they have completed their development and hibernate in leaves in the galleries they have made, pupating early in the spring. Owing to the fact that *R. pulicarius* remains in the parenchyma of the leaves throughout the larval and pupal stages till late in the spring, its control is easy; it is sufficient to rake up all the fallen leaves in the autumn and burn them. Any attempt to use insecticides against the adults would be useless, owing to the manner in which they feed, and if they are shaken from the trees, they are so active that it is impossible to collect them.

[Troitzkiĭ (N. N.).] **Троицкий (Н. Н.). Beiträge zur Kenntnis der Reblaus und der Reblauswiderstandsfähigkeit der Weinrebe. I. Die Reblausfrage in Mittel-Europa.** [Contribution to the Knowledge of *Phylloxera* and the Resistance of Vines to it. I. The *Phylloxera* Problem in Central Europe.] [*In Russian.*]—*Trud. prikl. Ent.*, xv, 200 pp., 45 figs., 2 maps, 129 refs. Leningrad, 1929. Price 2 *r.* 50 *k.* (With a Summary in German.)

A detailed account is given of a journey made by the author in the winter of 1927–28 to study the organisation, methods and technique of the control of *Phylloxera* in Germany, Austria and Switzerland. Much of the information has already been noticed. The history of the introduction and spread of this pest in these countries is reviewed in detail. The basis of control in all the three countries includes the prohibition of the importation of foreign vines, strict quarantine measures, periodical investigations of the condition of vineyards, the destruction

or treatment of heavily infested areas, and the substitution of infested vines by fruit trees, or in some cases the restoration of ruined vineyards on American wild stocks. The different ways in which each country carries out this programme are discussed in detail.

Experiments in Switzerland, and especially in Germany, have shown that it is possible to apply measures that prevent the introduction of *Phylloxera* from abroad and check the spread of the infestation. The destruction of infested vineyards is very effective, and is still often carried out in Germany. For this purpose about 13 fl. oz. carbon bisulphide are introduced into every 10 sq. ft. of soil through holes 6–12 ins. deep, which kills the majority of the infested vines ; these are then uprooted and burned, and the ground disinfected with kerosene or saprosol (a proprietary preparation containing 60 per cent. crude cresol and 30 per cent. soap). If after two years no live *Phylloxera* occurs in the treated places, certain crops may be planted, then the soil may be slightly ploughed and at last, 6 years after the vineyard has been treated, European vines may again be planted. The correct system of protecting healthy areas from infestation should be based, as it is in Germany, on the timely discovery of any indication of infestation in vineyards. The importance of supplying the vine-growers with seedlings from their own region, so as to avoid as much as possible the despatch of young plants from one part of the country to another, is emphasised ; in Germany the isolation of vine-growing districts is obligatory, and the supply of these with seedlings from other regions is effected only by State officials. All the seedlings are disinfected prior to their dispatch ; this rule is specially observed when resistant vines are sent to an area already sporadically infested, as the neogallicolae-radicicolae from leaf-galls on the seedlings may easily infest the roots of European vines. For this purpose the seedlings are fumigated with carbon bisulphide or calcium cyanide, or dipped in a 1 per cent. solution of saprosol for half an hour, or in hot water (52° C. [125·6° F.]) for 5–7 minutes. These measures and the technique of their application are discussed in detail.

The treatment of the soil of infested regions with carbon bisulphide is very effective. In Austria vast areas of vineyards, although infested for over 30 years, continue to be productive ; here every year carbon bisulphide is introduced into the soil at the rate of about 1 fl. oz. to every $10\frac{3}{4}$ sq. ft. The efficacy of this measure, however, depends to a great extent on the climate, the composition of the soil and the variety of vine. The choice of grafting stocks for infested regions is of special importance and should be based on personal experience and verification in each separate case ; sometimes it is wiser to destroy the infested vines. As the reaction of a given variety of vine to infestation varies in different areas, it is essential to determine the race of *Phylloxera* in each region.

The history of the scientific investigation on *Phylloxera* and the chief literature on the subject are reviewed ; the theory of Börner as regards the existence of two distinct races is discussed in detail, but the possibility of the formation of a series of modifications of the Aphid is not excluded. Both *P. vastatrix* and *P. vitifolii* exist in Russia ; in some districts the pest has been strictly localised for over 50 years and reproduces exclusively parthenogenetically, so that a study of possible local races would be of special interest. When studying the races of *Phylloxera*, the time factor should be taken into consideration ; reference is made to modifications that have occurred in *Eriosoma*

lanigerum, Hsm., during the 125 years of its existence in Europe in the absence of its primary food-plant (*Ulmus americana*) [*cf. R.A.E.*, A, xiv, 221 ; xvii, 118]. It is emphasised that all the methods of controlling *Phylloxera* used in Western Europe could be applied in Russia.

[Gusev (V. I.).] **Гусев (В. И.). Der Maikäfer in den Kiefernbeständen des Stawropoler Rayons (Samarascher Kreis).** [The Cockchafer in Pine Forests of the Stavropol District of the Samara Region.] [*In Russian.*]—8vo, 33 pp., 7 figs., 3 refs. Samara, Lesn. Otd. Sr.-Volzhsk. obl. zem. Upravl., 1929. (With a Summary in German.)

Investigations were carried out in the summer of 1927 to determine the intensity of infestation of the soil in pine forests with Melolonthid larvae. The technique of the work of digging out the larvae, etc., is described in detail. Those of *Melolontha hippocastani*, F., were the most numerous. Others in the order of their importance, but considerably less abundant, included *Polyphylla fullo*, L., *Amphimallus solstitialis*, L., *Anomala aenea*, DeG., *Serica brunnea*, L., and *Phyllopertha horticola*, L. The distinguishing characters of the larvae are given, with short notes on their bionomics.

In Samara *M. hippocastani* completes its life-cycle in four years. It attacks trees in shady places and is favoured by any factor that decreases the sunlight. Observations showed that growing agricultural crops prior to planting pine forests has a marked effect in reducing the intensity of infestation of the soil by Melolonthid larvae ; they did not occur at all where such crops had been recently grown for 4 or 5 consecutive years. Narrow strips of standing trees were more infested than broad ones, the majority of the larvae occurring in the southern outskirts of the strips. The larvae are more numerous in soil containing humus and in low places ; in hilly areas they occur chiefly on the southern and western slopes. A provisional calendar drawn up by the author for the larval stage of *M. hippocastani* indicates an abundance of the adults in 1929, with a gradual decrease in their numbers in 1930–32.

Brief notes are given on the control of *M. hippocastani*. Temporary nurseries should be planted in summer, when the larvae occur in the upper layer of the soil and are easier to dig out, and should be situated in glades entirely free from any tree growth or in places where the trees have been freshly felled. The nurseries should be surrounded by a ditch 2 ft. deep and 16 ins. wide to prevent the larvae migrating into them. Before planting a young forest the soil should be examined, and if more than 3 larvae occur to the square yard, no trees should be planted, as otherwise 75–80 per cent. of the young pines will be destroyed during the first year. Such infested areas should be used for agricultural crops for at least 4 years. Isolated deciduous trees and small groups of them may attract the adults of *M. hippocastani* for feeding and oviposition, and it should be obligatory to uproot them before growing the crops. The forest should be kept clear of old branches and rubbish, especially in the summer, and clear felling is recommended, as small belts of standing trees attract the beetles. Hand-collecting the adults is the only measure for immediate control and should be carried out simultaneously over the whole infested area. Sodium arsenite dusts proved to be ineffective, as the adults contain a

considerable amount of arsenic, which makes them resistant to the poison. Paradichlorobenzene kills the larvae in the soil, but further experiments on its employment are necessary.

[Rodd (A. E.).] **Родд (A. E.). Contribution to the Biology of** *Sphenoptera montana*, **B.Yak.** [*In Russian.*]—*Uzbekistan Expt. Sta. Plant Prot.* [Pubn.] no. 13, 17 pp., 5 figs. Tashkent, October 1928. Price 30 *kop.*

These observations were carried out in the summer of 1927 near Tashkent, where *Sphenoptera montana*, B.Yak., is an important pest of lucerne (*Medicago sativa*), the adults feeding on the leaves and the larvae on the roots. Some of the infested plants live for several years and are reinfested several times. The adult beetles emerge in September and hibernate. Their activity depends on the temperature ; they do not fly readily and do not feed at night. In the insectary oviposition began on 23rd April and lasted about six weeks. Each female lays 100–145 eggs, which hatch in 32–34 days. A description is given of the adults and eggs.

The eggs are laid singly on the stem or on the ground near the collar of the root. In nature most of them were laid in the second half of May. The larvae bore into the stem of the plant and mine in it until they penetrate into the root ; the number in a root varies from 1 to 7. Young larvae can remain without food for over 24 hours, so that those that hatch from eggs laid on the ground easily reach their food-plant. The larval stage lasts 40–50 days.

Pupation occurs in the beginning of August in strong cocoons in the galleries made by the larvae in the roots. This stage lasts 14–18 days, but the young adults remain in the cocoons for several days, after which they eat their way out and move along the gallery to the root collar ; here they bore a hole, through which they come to the surface.

An important parasite of *S. montana* is a Braconid of the genus *Glyptomorpha*, which destroys the larvae, the adults being abundant about the middle of June. In each root the parasite infests not more than two larvae of the host in the part of the gallery near to the surface of the soil. Hibernation (as a mature larva) and pupation occur in a cocoon in the gallery, and the young adults make their way to the root collar, where they leave the mine through a crack or hole. Sometimes, when the root is not too thick, the parasite bores a fresh hole, but it often fails to make its way out and dies. In 1927 about 20 per cent. of the larvae of *S. montana* were destroyed by this Braconid, but it is itself checked by a secondary parasite.

Another important parasite of *S. montana* is a Chalcid, large numbers of the larvae of which occur on a single host larva. It also infests the pupae, and it probably has several generations in the summer; in 1927 it destroyed about 33 per cent. of the beetle. It hibernates in the larval stage and pupates in the galleries of the host, from which the adults bore their way out.

Less important enemies of *S. montana* include a fungus, the larvae of a Clerid beetle, which feed on the larvae and pupae, but also destroy those of the Braconid and the Chalcid, and ants, which attack the larvae of *S. montana* in roots that have already been infested once and into which they can penetrate through the holes made by the adult beetles in previous years.

KUWAYAMA (S.). **The principal Insect Pests of the Rice Plant in Hokkaido.** [*In Japanese.*]—*Bull. Hokkaido Agric. Expt. Sta.*, no. 47, 107 pp., illus. Sapporo, November 1928.

More than 30 species of insects attack the rice plant in Hokkaido, of which those discussed below are among the more important.

The Leptocerid, *Setodes argentata*, Mats., has one generation a year, hibernating in the larval stage. The larvae become active from May onwards, feeding on the rootlets and sometimes causing serious damage. Pupation takes place from the middle of June, the adults appearing in 7–10 days. The eggs hatch in 2 weeks. Spraying with kerosene on drained fields kills the larvae. *Tipula parva*, Lw., appears to have two generations a year, hibernating in the larval stage ; the adults occur in May and June and again in the autumn. The eggs are laid on the damp soil, and the larvae tunnel into it, feeding on the young shoots and other vegetable matter. The damage is most severe from the middle of June to the beginning of July. *Chironomus oryzae*, Mats., has three or four generations a year and feeds on the young shoots in the larval stage. *Erirrhinus oryzae*, Mats., hibernates as an adult or pupa, having one generation a year. The weevils appear in May and June and the larvae feed on the roots or basal parts of the stalk, maturing late in September.

Chilo simplex, Butl., has one or sometimes two generations a year ; it usually hibernates in the larval stage, but a few individuals may hibernate as pupae. Pupation takes place from the end of May onwards, the moths appearing about 3 weeks later, usually from the end of June to the end of August, and sometimes again from the middle of August to the beginning of October. They lay their eggs in masses, 2 or 3 days after emergence, on the distal portions of the leaves ; the egg stage lasts 1–2 weeks. *Trichogramma japonicum*, Ashm., is an important parasite of the eggs, and *Chelonus munakatae*, Mats., *Elasmosoma* sp., *Diaparsis japonicus*, Ashm., and *Lissonota* sp. are parasitic on the larvae. *Delphacodes* (*Liburnia*) *furcifera*, Horv., which feeds on wheat and other graminaceous plants as well as rice, sometimes causes serious damage. The last outbreak occurred in Hokkaido in 1924, the temperature during July and August being higher than usual. There are from two to four generations a year, according to the temperature, and hibernation takes place in the nymphal stage. The adults appear in June and all stages occur until the end of September. The egg stage lasts 1–2 weeks and the nymphal stage 17–28 days.

Echinocnemus bipunctatus, Roelf., has one generation a year, usually hibernating in the adult, but sometimes in the pupal stage, in the soil [but *cf. R.A.E.*, A, vii, 273]. The weevils appear from the beginning of June and travel on the surface of the water, cutting off the apical parts of the leaves. The larvae feed on the roots as well as on decaying vegetable matter and other graminaceous plants. The Criocerid, *Lema melanopa*, L., occurs throughout Japan and Formosa, and causes serious damage. There is one generation a year, hibernation taking place in the adult stage. The beetles appear from the end of May and feed on the leaves, on the distal parts of which the eggs are laid in irregular rows. The larvae hatch in 7–13 days and feed on the upper surface of the leaves ; they pupate in 10–20 days and the beetles emerge 10–17 days later. The Noctuid, *Naranga aenescens*, Moore, is distributed throughout Japan and Formosa and is very common in Hokkaido, where it has two generations a year, hibernating in the pupal

stage. The moths emerge at the beginning of June and again late in July, and lay eggs on the leaves. The larvae hatch in 5–7 days and feed on the leaves, folding the apical portions for pupation. The pupal stage lasts about 10 days in summer. *Nesopimpla narangae*, Ashm., parasitises the larvae. The adults of *Oscinis oryzella*, Mats., emerge from the end of May onwards. The eggs are laid on the distal portion of the leaves, in which the larvae mine. *Chlorops oryzae*, Mats., has one generation a year, the flies appearing from the end of June, and the larvae boring in the stalks in July. *Locusta migratoria*, L., ph. *danica*, L., occurred in abundance in Hokkaido in 1880 and 1920, causing severe damage. It has one generation a year, the eggs hatching from the end of May to the beginning of July and the adults appearing 7–8 weeks later. The Pyralid, *Cnaphalocrocis medinalis*, Guen., sometimes occurs in large numbers, causing severe injury. *Porthetria* (*Lymantria*) *dispar*, L., feeds on a very wide range of plants, and rice may be attacked when the larvae are numerous.

An account is also given of the pests of stored rice in Hokkaido, including the following : *Calandra oryzae*, L., which has two generations a year, *Tribolium castaneum*, Hbst. (*ferrugineum*, F.), *Silvanus surinamensis*, L., *Laemophlocus minutus*, Ol. (*pusillus*, Schönh.), *Tenebroides mauritanicus*, L., *Tinea granella*, L., *Sitotroga cerealella*, Ol., which has two generations a year, and *Aglossa dimidiata*, Haw., which has one generation a year.

Other pests found in Honshiu but not occurring in Hokkaido include : *Nephotettix apicalis*, Motsch., var. *cincticeps*, Uhl., *Deltocephala dorsalis*, Motsch., *Aenaria lewisi*, Scott, *Scotinophara* (*Podops*) *lurida*, Burm., *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), and *Sesamia inferens*, Wlk.

Kono (H.). **On two new Genera of Rhynchitinae and their Life-history.** [*In Japanese.*]—*Trans. Sapporo Nat. Hist. Soc.*, x, pt. 2, pp. 122–137, 4 figs. Sapporo, 1929. (With a Summary in German, pp. 136–137.)

Chokkirius, gen. n., is erected for *Rhynchites* (*Deporaus*) *rosti*, Schilsky, which feeds on the young leaves of *Acer* spp. in Hokkaido ; and *Taiwanobyctiscus*, gen. n., for *Byctiscus paviei*, Auriv. (type) and *B. formosanus*, Voss, the former feeding on the rolled leaves of *Vitis heterophylla*.

Hori (M.). **Two new Species of Aphids parasitic on Poplar in Hokkaido.**—*Trans. Sapporo Nat. Hist. Soc.*, x, pt. 2, pp. 109–115, 2 figs. Sapporo, 1929.

Melanoxanthelium yezoense, sp. n., occurs on various species of poplar (*Populus*), and *Doraphis populi*, gen. et sp. n., which is described by Matsumura and Hori, on *P. maximowiczii*. The alate viviparous females of both species, the apterous viviparous female of *M. yezoense* and the pupa of *D. populi* are described.

Otanes (F. Q.) & Toquero (A. G.). **Notes on the Mango Twig Borer** (*Euclea capito*, **Pasc.**).—*Philipp. Agric. Rev.*, xx, no. 2, pp. 249–250, 4 pls. Manila, 1927. [Recd. 1929.]

The Lamiid, *Euclea capito*, Pasc. (mango twig-borer) is a common pest of mango (*Mangifera indica*) in the Philippines and also attacks

numerous other plants, including avocado, *Citrus* and camphor (*Cinnamomum camphora*). In feeding and ovipositing, the beetle girdles the twigs, a single egg is laid in each, and the larva on hatching tunnels in the centre, so that the infested twigs eventually die. All stages of the insect are briefly described. The egg stage lasts 4–7 days, the larval 126–222 days and the pupal 12–20 days.

Badly infested twigs should be cut off as soon as possible and piled up on the ground for at least a month to allow parasites of the larva to emerge. Later the twigs may be burned, but if the cutting is done early there is no danger of adult beetles emerging. As one female is capable of infesting 30 or more twigs, the beetles should be collected and destroyed. In and around Manila they are common from June to September, and collecting should be started in June when egg-laying usually begins. Smoke tends to drive away not only these beetles but also the mango hoppers, *Idiocerus niveosparsus*, Leth., and *I. clypealis*, Leth., which are the most serious pests of mango. Insectivorous birds, such as woodpeckers, should be protected and encouraged.

Otanes (F. Q.) & Sison (P.). **Notes on the Diamond Back Moth, *Plutella maculipennis* Curtis.**—*Philipp. Agric. Rev.*, xx, no. 2, pp. 251–254, 1 pl. Manila, 1927. [Recd. 1929.]

Plutella maculipennis, Curt. (diamond-back moth), which is a serious pest of cabbages and other cruciferous vegetables, is particularly destructive in the Philippines at higher altitudes where cabbages are grown extensively. The eggs are usually laid on the lower surface of the leaves, and the larvae feed on the plants, which may be so damaged that they become stunted and produce no heads. The injury resembles that caused by the larvae of *Crocidolomia binotalis*, Zell., which is even more common and more destructive to cruciferous plants in the Philippines [*R.A.E.*, A, xv, 552]. On radishes and pechay [*Brassica juncea*], the larvae even destroy the flowers and young pods and feed on the skin of the stem. All stages of the insect are briefly described. The egg stage lasts 3–5 days, the larval stage 7–11 days and the pupal stage 3–6. The moths, which hide on the lower surface of the leaves during the day, begin to lay eggs after a day or two. Oviposition usually takes place at night, each female depositing an average of 65 eggs, either singly or in groups of 2–4. The larvae, which are very active, generally feed during the cooler parts of the day. Pupation usually takes place on the lower surface of the leaves near the mid-ribs or at the folded margins. An Ichneumonid parasite, probably *Angitia plutellae*, Vier., has been reared from the larvae and pupae, and is attacked by a hyperparasite, possibly *Spilochalcis delira*, Cress. [*R.A.E.*, A, v, 449].

The larvae may be killed with a solution of ½ lb. soft yellow laundry soap in 4 gals. water sprayed early in the morning or late in the afternoon on the lower surface of the leaves. Lead or calcium arsenate at the rate of 1½–4 lb. to 100 gals. water may also be used ; it will adhere better if a small amount of resin soap is added. If Aphids and Aleurodids are also present on cabbages, the following combined formula may be used : 10–25 lb. soft yellow laundry soap and 1½–4 lb. lead or calcium arsenate to 100 gals. water. The soap is lethal not only to Aphids and Aleurodids but also to the larvae if the maximum

amount (25 lb.) is used, and at the same time it serves as an adhesive for the lead or calcium arsenate. Collection of the eggs, larvae and pupae is also recommended.

Akar toeba (*Derris elliptica*) **het bestrijdingsmiddel van de Tabaksluis** (*Myzus persicae*) **in Deli.** [Derris, the Insecticide used against the Tobacco Aphid, *M. persicae*, in Deli.]—*Meded. Deli Proefst.*, (2) no. 58, 61 pp., 2 pls., 51 refs. Medan [1928]. (With a Summary in English.)

A water extract of the roots of *Derris elliptica* has proved an excellent insecticide against the Aphid, *Myzus persicae*, Sulz., which is a serious pest of tobacco in Deli, Sumatra. This paper gives the results of the work done by the Deli Experiment Station. In chapter I, which is introductory, Dr. J. Kuijper states that experiments made in 1922 by Dr. Fulmek having proved successful, the Station in 1926 began the manufacture of an extract to be used as a stock solution, and a yearly output of over 13,000 gals. is now supplied to the estates. In chapter II, Dr. S. C. J. Jochems reviews the literature on *D. elliptica* (the references by older authors being concerned with its use as a fish-poison), with a botanical description of this Papilionaceous creeper and an account of its cultivation in Malaya. Two species occur in Malacca, *D. elliptica* and *D. malaccensis*, the former being the commoner. One of the difficulties in marketing the root is the lack of a chemical reaction that gives a definite measure of its quality as an insecticide.

In chapter III, M. de Groot describes the preparation of the stock extract. The water content of fresh roots varies and may reach 50 per cent. Dried roots are chopped into pieces 1–2 inches long, and 6 times their weight of water is added, less water being used for fresh roots. The roots are crushed in the water by millstones (an oil-mill was used) and then passed through a sieve, the residue being pressed in a hydraulic press. The liquids obtained by straining and pressing are mixed and passed through a fine strainer. This stock solution is diluted with 50 parts water for use. It is really an emulsion and requires stirring or shaking before dilution. The addition of $\frac{1}{2}$ per cent. of formalin preserves the stock for a period up to a year, provided that the container is sealed to prevent the formalin from evaporating. In chapter IV J. C. van der Meer Mohr describes tests on fish.

Chapter V, by Dr. J. K. de Jong, describes tests of derris (1–$2\frac{1}{2}$ per cent.) and nicotine sulphate (1–3 per mille) against *Myzus persicae*. Tobacco leaves with at least 300 Aphids were dipped twice into the liquids, and derris was found to be at least as effective as nicotine sulphate, though perhaps somewhat slower in action. In field tests, tobacco plants were sprayed and counts of the surviving Aphids were made after 48 hours. The table of results shows the striking superiority of derris, the reason being thought to lie in the rapid evaporation of the nicotine sulphate. In these tests the addition of soap did not increase the effect of the spray.

In chapter VI J. C. van der Meer Mohr describes experiments that show that derris has no effect on Lepidoterous pests of tobacco, *Prodenia litura*, F., being the caterpillar used. Syrphid flies are also resistant, a point of interest because they are valuable natural enemies of *M. persicae* in Deli. In chapter VII, P. A. Rowaan reviews the

literature on the chemistry of the poisonous principle in derris root. Tubatoxin or rotenon is the most important element in the latex. Attempts are still being made to find a simple method for testing the roots and extracts.

MENZEL (R.). **Bestuivingsproef vanuit een vliegtuig op de theeonderneming Malabar.** [An Experiment in Dusting from an Aeroplane in the Malabar Tea Estate.]—*Arch. Theecultuur*, no. 4, pp. 276–284, 7 figs., 4 refs. Buitenzorg, December 1928. (With a Summary in English.)

In tea plantations dusting from the air seems best suited to estates where there are few or no leguminous trees and where the ground is open. In these circumstances this method seems an economic one against *Helopeltis*, caterpillars and mites infesting large areas. In June 1928 a trial was made on an estate in Java, when an experimental area of about 5 acres was dusted in a few minutes, in 4 flights, with 132 lb. of sulphur, which resulted in the tea bushes being covered with a coating of this substance.

VAN DER MEER MOHR (J. C.). **Resultaten van de in 1928 genomen bestuivingsproeven ter bestrijding van schuurrupsen.** [Results of the Dusting Experiments made in 1928 against Caterpillars in Tobacco Drying Sheds.]—*Vlugschr. Deli Proefst.*, no. 46, 3 pp. Medan, January 1929.

In further tests against Lepidopterous larvae infesting tobacco in drying sheds in Deli, Sumatra [*cf. R.A.E.*, A, xvi, 377], dusting with lead arsenate and calcium arsenate was tried with a motor-driven duster and with a hand-duster. In all cases the dusted tobacco was less injured than the untreated, there being an average of 15 per cent. less damaged leaves. In the drying sheds lead arsenate gave better results than calcium arsenate, a result quite unexpected in view of the excellent results with the latter in field experiments [*loc. cit.*]. In conclusion, 12 tests made in 3 years have shown in 11 cases a definite advantage in dusting tobacco in the drying sheds.

NEGI (PRATAP SINGH). **A Contribution to the Life History of the Lac Insect,** *Laccifer* (*Tachardia*) *lacca* (**Coccidae**).—*Bull. Ent. Res.*, xix, pt. 4, pp. 327–342, 1 pl., 6 figs. London, March 1929.

The possibility of distinguishing the sexes in newly-hatched larvae of *Laccifer lacca*, Kerr, has been much disputed. The author found by experience that though it is possible in many cases to distinguish the sexes of the larvae with a binocular microscope, the method is tedious and of little practical value. He has therefore made a thorough study of the resinous developments in the first few larval stages, showing that the sexes can be distinguished by them, and also gives descriptions of the first stage larva and of the metamorphosis in both male and female. The ovary and ducts of the female and the mechanism of emergence of the larva are described and explained. Sudden cold and rain causes cessation of emergence of the larvae, the female being able to control emergence to some extent. The female does not die until practically all the living, fully-developed larvae have passed out from the ovaries

into the incubating chamber (a space formed between the body of the mother and the lac test). It is therefore to the interest of the cultivator to allow full development of the female on the food-plant and to remove the crop (particularly that portion to be used as brood lac) not more than 8 to 12 days prior to emergence of the larvae. If the brood lac is removed earlier, the female does not get full nourishment, and though the embryos may develop, hundreds of young larvae fail to emerge owing to lack of vitality of the mother, while those that do emerge soon die. The author concludes, contrary to theories previously advanced, that lunar periodicity cannot affect the emergence of larvae.

THOMPSON (W. R.). **On the Relative Value of Parasites and Predators in the Biological Control of Insect Pests.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 343–350, 18 refs. London, March 1929.

The author discusses the relative value of insect parasites and predators in the biological control of their insect hosts. An enumeration of the predacious and parasitic families shows the former to be much more varied in structure, habits and distribution than the latter. The general idea that predators are less reliable in biological control than parasites is due chiefly to the belief that they are less specific in their choice of hosts. The author believes this supposition to be incorrect, and, in point of fact, there seems to be relatively little difference in the specificity of polyphagous parasites and predators. Again, the author does not agree with the largely accepted theory that oligophagous or polyphagous parasites are markedly inferior to monophagous species in the control of pests. The polyphagous species will always distribute its progeny among several hosts in proportions depending upon its individual preferences and the relative numbers of each species available ; if one of the hosts begins to increase, that host will tend to receive a greater proportion of eggs or larvae, unless it is only slightly attractive. The parasites with high reproductive rates are not necessarily the most effective, for the method of oviposition is frequently extremely wasteful ; there does not seem to be, in fact, any striking difference in the effective rate of reproduction of parasites and predators. Moreover, each individual predator devours a large number of insects during its life, whereas the parasite destroys one at the most. Mathematical calculations are given showing the length of time necessary for the annihilation of a given host population by given populations of gregarious parasites, solitary parasites and predators. Other things being equal, a predator that devours 100 hosts during its life will reduce an outbreak 100 times as fast as a solitary parasite and 1,000 times as fast as a gregarious parasite depositing 10 eggs in each host attacked, provided that the reproductive rates of host and enemy are equal. The difficulty of detecting the work of predators and estimating their importance, as compared with that of parasites, is considerable, and equations are used to show the relation necessary between the numbers and reproductive rate of a beneficial insect and those of its host if control is to be effected. The destruction of many hosts during the life of a predator will often compensate for a low rate of reproduction.

These theoretical conclusions concerning the value of predators are strongly supported by the results obtained in practical biological

control work. The relative importance of the two types of controlling agencies in any given case can, however, only be decided by careful investigation in the field.

Evans (J. W.). **A new Species of *Nysius* (Hem., Lygaeidae) from Australia.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 351–354, 3 figs., 6 refs. London, March 1929.

An examination of numbers of the Rutherglen bug, which has been recorded from every State in Australia, has shown that two distinct species occur in Queensland. One is here described as *Nysius clevelandensis*, sp. n., taken on *Sonchus oleraceus*, *Gnaphalium purpureum* and *Erigeron linifolius*, from Cleveland. The other agrees with Bergroth's inadequate description of *N. vinitor*, and is here re-described. As considerable confusion regarding the genus exists, the author gives a key to the genera included under *Nysius*, auctt., of which two are new, with notes on some of the species.

Mahdihassan (S.). **Pupal Parasites of *Holcocera pulverea*, Meyr. (Lep.), an Enemy of the Lac Insect.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 355–356, 1 fig., 3 refs. London, March 1929.

Much damage is done to lac cultivation in India by two predators of the lac insect, namely, *Holcocera pulverea*, Meyr., and *Eublemma amabilis*, Moore. The activities of the former, however, are much limited by two Chalcid parasites of the pupae, of which *Eurytoma pallidiscapus*, Cam., is abundant in Mysore, but is very rare in the north of India, whereas *Brachymeria* (*Chalcis*) *tachardiae*, Cam., which may be a parasite of either *E. amabilis* or *H. pulverea*, is rare in Mysore, but seems to replace *E. pallidiscapus* in the north.

Marshall (G. A. K.). **New Curculionidae (Col.) from cultivated Plants.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 391–400, 5 figs. London, March 1929.

The new weevils described are *Mimaulus matabelenus*, on tobacco in S. Rhodesia; *Tanymecus arushanus* and *Systates habenatus*, on cotton foliage in Tanganyika; *Peloropus batatae*, bred from sweet potatoes in Uganda; and *Cholus pistor*, Boh., subsp. *bahiensis*, bred from stems of *Paspalum densum*, *Rhyssomatus psidii*, on guava trees, the larvae attacking the buds, *Conotrachelus bondari*, attacking the stems, buds and fruit of the custard apple (*Anona squamosa*), and *Metoposoma canavaliae*, boring in stems of *Canavalia* beans, all from Brazil. A note is given distinguishing the characters of the genera *Metoposoma* and the closely allied *Metriophilus*.

[Dekhtyarev.] Dekhtiarev (N. S.). **Insects injurious to Sunflower in Ukraine.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 411–419, 5 figs. London, March 1929.

A number of insect pests of the sunflower (*Helianthus annuus*) in the Ukraine are dealt with, notes on the life-histories being given, and other food-plants enumerated. Among the more important, *Mordellistena parvula*, Gyll., lives in the larval stage in the soft core of the

sunflower stem, in which it makes long, winding passages, producing in the plant a stunted appearance and sometimes light or empty seeds. The presence of the larvae seems to encourage the sunflower disease caused by *Sclerotinia libertiana*. Burning the dry sunflower stems after collection of the crop is a very efficient method of controlling *M. parvula*. The larva of the Longicorn, *Agapanthia dahlii*, Richt., causes similar damage; by the time the larvae are full-grown, in August–September, the pith of the sunflower may have been consumed right down to the root, so that if the stems are merely cut down the larva remains in the ground. The best remedy is to burn the roots of the sunflowers. *Lethrus apterus*, Laxm., generally lives on uncultivated land, and frequently spreads to crops. Young sunflower plants are sometimes completely cut into pieces and carried off into the burrows of the beetles. Clean-cut trenches are effective in stopping the migrations of these wingless insects, and hand-collection of the adults, which are dropped into pails containing kerosene, is also practised, but they are not easily caught. A ball of wadding soaked in carbon bisulphide and stamped into the burrow with the foot is also efficacious.

The larva of the sunflower moth, *Homoeosoma nebulella*, Hb., is the most serious pest of sunflowers. The females seek out the ripest blossoms, from which they suck the nectar and in which they oviposit. The larvae feed on the pollen and later on the blossom, finally gnawing into the ovary, passing from one seed to another. Resistant strains of sunflowers should be planted for preference. Dusting the blossoms was carried out experimentally with a hand duster, using calcium arsenate with lime or lead arsenate with sulphur; the results were very satisfactory and will be repeated on a larger scale.

Outbreak of Army Worm in Southern Rhodesia.—*Rhodesia Agric. J.*, xxvi, no. 2, pp. 153–155. Salisbury, February 1929.

The Noctuid, *Laphygma exempta*, Wlk. (army mystery worm), has appeared in numbers in several districts in Southern Rhodesia, and considerable damage to maize is reported. The eggs, which are laid in clumps on the food-plants, hatch in a few days. The caterpillars develop in about 3 weeks in the summer and pupate in the soil, the pupal period lasting about a fortnight. Their food-plants [*cf. R.A.E.*, A, xvi, 334] include cotton, which is not often damaged to any great extent, and young sunflowers. Spraying infested veldt with sodium arsenite [*loc. cit.*] will prevent an invasion of maize lands. Maize may also be protected by strewing leaves of grasses across the line of march and spraying them as frequently as necessary with the poison; the bait may also be strewed in a furrow, of which the side near the maize should be made as steep as possible. Mechanical destruction of the caterpillars might sometimes be effected in an emergency by the use of brush drags. A few rows of plants around the infested part of a crop may be sprayed with lead arsenate, 1 lb. powder to 25 gals. water, but this treatment, though not injurious to the plants, is expensive on a large scale.

Controlling the Elegant Grasshopper.—*Fmg. S. Africa*, 1929, reprint no. 11, 1 p. Pretoria, January 1929.

The elegant grasshopper [*Zonocerus elegans*, Thunb.] does extensive damage in orchards and gardens in South Africa. Though it does not

migrate or form compact swarms, organised attacks on groups of grasshoppers early in the morning by gangs of natives armed with flexible swatters constitute the cheapest and most satisfactory method of control. The grasshoppers can also be destroyed on weeds, etc., by spraying with sodium arsenite, 3 tablespoonfuls (powder or liquid) to 4 gals. water; or particular trees or crops may be protected by spraying with lead arsenate, 1 lb. powder to 4 gals. water. This mixture is safe on most plants, though it may scorch tender foliage and affects the flavour of *Citrus* fruit.

GUNN (D.). **Fruit-piercing Moths.**—*Fmg. S. Africa*, 1929, reprint no. 19, 4 pp. Pretoria, February 1929.

Three species of fruit-piercing moths, *Achaea lienardi*, Boisd., *Serrodes partita*, F., and *Sphingomorpha chlorea*, Cram., were exceedingly numerous in the eastern districts of Cape Province and caused extensive damage to fruits of *Citrus* and deciduous trees during the autumn and early winter of 1925. As a result of perforation by these moths, oxidation and fermentation occur, and the fruit begins to decay, drops from the tree and finally rots. Pomace flies [*Drosophila*] sometimes enter the perforations and oviposit in the tissue, the larvae being frequently mistaken for those of fruit-flies. Several moths may be found feeding on a single fruit, and sound and injured fruit is indiscriminately attacked. The fruits attacked include apricots, apples, figs, grapes, guavas, litchees, peaches, pears, nectarines and oranges. Lemons and grapefruit do not appear to be injured. The eggs are deposited chiefly on native plants, and the larvae, which in most species are nocturnal in their feeding habits, generally become mature without being observed. They have been recorded, however, on *Acacia*, Australian myrtle [*Eugenia smithi*], rose, *Eucalyptus* and occasionally cabbage. Though the moths also are nocturnal feeders, they have been observed feeding on oranges in the daytime when they were very numerous. They appear in November and December, when the apricots are ripening, and are prevalent in orchards until the end of the fruit season. In April and May 1928 they appeared on *Citrus* and remained until early June when the weather became cold. The moths have been satisfactorily controlled by the use of tins containing poisoned baits, consisting of $1\frac{1}{2}$ oz. lead arsenate powder or $\frac{1}{2}$ oz. sodium arsenite, 53 oz. treacle or $2\frac{1}{2}$ lb. low grade sugar, and 4 gals. water. The bait is more attractive if a fruit is cut in halves and placed in it cut side up. It may also be poured over crushed ripe fruit placed in large tins. The tins should be hung on outside branches or poles. The bait must be stirred at intervals and added to as it evaporates, and the dead moths removed. Between January and June 1928, 19,000 moths were caught in about 100 tins in *Citrus* orchards. In orchards where considerable damage had been caused to deciduous fruit in previous years, the loss was reduced in 1928 to about 4 per cent. by the use of lead arsenate and treacle bait.

PETIT (G.). **Sur l'introduction à Madagascar du** *Dactylopius coccus* **Costa, parasite de l'** *Opuntia vulgaris* **Mill.**—*C.R. Acad. Agric. Fr.*, xv, no. 9, pp. 410–416. Paris, 1929.

The author discusses the advisability of destroying *Opuntia vulgaris* by means of the introduction of the Coccid, *Dactylopius coccus*, Costa,

into Madagascar, where the problem is rather unusual owing to the fact that sundry uses are made of the plant by the natives. At points in the Island where the Coccid has been liberated, large tracts of *Opuntia* are being exterminated, one area of about 25,000 acres having been completely destroyed in eight months.

CHIAROMONTE (A.). **Nota preliminare su una nuova specie di *Pseudantonina* dannosa all' *Agave sisalana* nella Colonia Eritrea, *Pseudantonina agaves*, n. sp.** [A preliminary Note on a new Species of *Pseudantonina* harmful to *A. sisalana* in Eritrea, *P. agaves*, sp. n.]—*Agric. colon.*, xxiii, no. 2, pp. 61–67, 2 pls., 1 ref. Florence, February 1929.

A description is given of *Pseudantonina agaves*, sp. n., injurious to sisal, *Agave sisalana*, in Eritrea. Colonies of individuals in all stages of development have been found between the bunch of closed leaves and those already open. After the tissue of the outer leaf of the bunch has been killed by the punctures, the Coccid punctures the leaf beneath and continues thus into the centre. A strong wind then breaks the plant at the weakened spot.

The Agricultural Journal of Egypt.—New Ann. Ser. 1924–25 [Vol. ii], 166 pp., illus. Cairo, Ministry of Agriculture, Egypt, 1928. Price, P.T.5 [1*s.* 0½*d.*].

This volume contains the following papers of entomological interest that were originally published in Arabic in 1924–25 : A Recent Introduction of a Beneficial Insect into Egypt, the Australian Ladybird Beetle (*Cryptolaemus montrouzieri*, Muls.), by A. M. Mistikawy ; The Use of Arsenical Preparations against Cotton Pests in Egypt, by C. B. Williams ; Citrus Trees Fumigation Campaigns in Egypt, by J. D. Shepherd ; Fumigation of Citrus Trees in Egypt, by Naguib Iskandar ; and The Mediterranean Fruit Fly [*Ceratitis capitata*, Wied.], by Abdel Aziz el Ghawabi.

HARGREAVES (E.). **Report on the Entomological Section. Section I.**—*Rep. Lds. For. Dept. Sierra Leone 1927*, pp. 18–20. Freetown, 1928.

Much of the information contained in this report has already been noticed [*R.A.E.*, A, xvi, 244, 303]. *Aspidiotus destructor*, Sign. (coconut scale) has spread to a certain extent, but in most localities previously infested coconut palms have recovered and are bearing well. Natural enemies, comprising the Coccinellids, *Chilocorus schiödti*, Muls., and *C. dohrni*, Muls., and the parasitic fungus, *Pseudomicrocera henningsii*, have been collected and distributed. The fungus is apparently difficult to establish in situations close to the sea, though it has controlled the scale in one locality. The caterpillar attacking the nuts of kola [*Cola acuminata*] has been identified as the larva of *Characoma stictigrapta*, Hmps. It was observed that there is a definite general movement of the immature stages of *Zonocerus variegatus*, L., in an easterly direction, and that towards the end of the dry season there is a movement in the reverse direction, which indicates that the locust returns to its original breeding ground [xvi, 246]. In 1927 the immature locusts appeared on 10th September, earlier than in 1926, but were less numerous. Termite mounds, varying from 1–9 ft. in height and 2–6 ft.

in diameter at the base, were successfully treated with carbon bisulphide, 40–180 cc. being introduced through a small hole in the top of the mound. At least three days should be allowed for the vapour to penetrate to all parts.

MUNGOMERY (R. W.). [**Report of the Southern Assistant Entomologist, November-December 1928.**]—*Queensland Agric. J.*, xxxi, pt. 2, pp. 105–108. Brisbane, 1st February 1929.

During the past two years, laboratory and field observations have been made on the life-history of the Dynastid, *Pentodon australis*, Blackb., which is distributed throughout practically all the sugar-cane growing districts of Queensland. In the south it occurs in the low-lying clay soils, where it eats the eyes and tender shoots of germinating sets, whereas in the drier, red volcanic soils it apparently does no damage. Its presence appears to be correlated with that of *Paspalum*, and young cane is most seriously injured when planted immediately after a good crop of this grass. Although the beetles are known to feed more or less throughout the year, feeding becomes more pronounced at the beginning of spring, shortly before the eggs are produced. These are laid singly in the soil at depths of 6–8 ins., the first eggs being observed towards the end of August. At this time hatching takes place in about 26 days at a mean temperature of 63° F. As the temperature rises, the rate of oviposition increases, reaching its maximum in October and November, after which it decreases rapidly. At the same time the length of the hatching period lessens, being 19 days in October at a mean temperature of 69° F., and only 14 days in December at 75° F.

Soon after hatching the young larvae begin to feed actively, deriving most of their nourishment from the large quantity of soil and rotting vegetation they ingest before becoming full-grown. They, as well as the adult beetles, are sometimes responsible for damage to sugar-cane, the injury consisting in eating into the end of the cane sets and hollowing them out. The larval stage, including the prepupal period, lasts approximately 75–85 days and the pupal stage 14 days, the entire life-cycle from egg to adult lasting about 4 months. There is usually one generation a year ; the beetles emerging in February and March from eggs laid in October and November do not as a rule oviposit until the following spring. Beetles emerging in December or January, however, may oviposit soon after feeding, so that occasionally there are two generations, and the finding of isolated third-instar larvae in the field as late as June supports the possibility of there being two generations under natural conditions, unless these larvae are the result of a late production of eggs by the original spring beetles. The beetles lay a few eggs at a time over a long period, and beetles that have been living in confinement for two years have produced eggs after each winter and are still active and functioning.

With regard to control measures, cane should not be planted immediately after *Paspalum*, and a period of two months or more should elapse between ploughings in the spring and summer months, so that the larvae may be exposed to insectivorous birds. If possible, planting should be done in the autumn, but if it must be done in spring, the ground should be prepared some time before and left fallow so that the beetles are forced to migrate elsewhere for their food supply. The adults should also be collected, and large plants be selected for setting out [*R.A.E.*, A, xv, 176].

JARVIS (E.). **Cane Pest Combat and Control.**—*Queensland Agric. J.*, xxxi, pt. 2, pp. 108–110. Brisbane, 1st February 1929.

During 1928–29 tests were carried out with arsenicals sprayed on the food-plants of the greyback cockchafer [*Lepidoderma albohirtum*, Waterh.] based on the results of laboratory trials made in previous years [*R.A.E.*, A, xv, 348]. Light wooden frames covered with mosquito netting were placed over young trees of *Ficus pilosa* 4–5 ft. high. In one experiment the wooden bottom of the frame enclosing the tree stood on flat sheets of galvanised iron, on which, close to the stem of the tree, were placed tins of moist soil and other suitable shelter for the beetles during the daytime. The foliage was sprayed with lead arsenate (2 lb. to 8 gals.) to which a little casein had been added to ensure spreading, and 100 individuals of *L. albohirtum* that had probably not been on the wing more than about 4 days were collected on 26th November and placed in the frame. Mortality commenced after the second night of feeding and continued at intervals until 5th December. None of the beetles lived more than 10 days after capture, and as portions of several of the leaves had been eaten, it is assumed that about 75 per cent. had either nibbled the edges or devoured the poisoned epidermis. Fully 80 per cent. sheltered during the day in the soil provided, though large numbers were usually found resting in a torpid condition on the sides or corners of the frames, and a few on the leaves of the tree. When the soil was used as the floor of similar cages, practically all the beetles passed the day underground. In another cage where the tree was sprayed with 2 lb. lead arsenate to 10 gals., two females died on the following day, proving the toxicity of the poison at this strength ; moreover, the spray does not injure the leaves of the trees nor check the growth of the buds at the ends of the shoots.

On 16th November calcium arsenite, mixed in the proportion of 8 oz. sodium arsenite and 6 lb. quicklime to 20 gals. water, was tested, the frame over the trees being let into the ground to a depth of 4 ins. Conclusive data regarding mortality were not, however, available, as more than half of the 52 beetles placed in the cage escaped by tunnelling. The poison proved fatal after the fifth night, and 15 beetles were found dead between 21st and 24th November. The results of these experiments indicate that a row of small trap trees [*loc. cit.*], planted about 4 chains apart on some suitable headland and sprayed with lead arsenate as soon as possible after the emergence of *L. albohirtum*, would considerably reduce the numbers of beetles on sugar-cane in the vicinity.

SUMMERVILLE (W. A. T.). **The Control of Meat Ants.**—*Queensland Agric. J.*, xxxi, pt. 2, pp. 111–113. Brisbane, 1st February 1929.

When present in large numbers or nesting in certain places, *Iridomyrmex detectus*, Sm. (common meat ant) may cause much annoyance and in some cases assume the proportions of a pest. Experiments have therefore been carried out to determine an efficient method of control. Carbon bisulphide proved an effective though not particularly cheap means of control. For a nest having a mound of 18–25 cu. ft., a little less than ½ pt. should be poured into the main entrance holes, the nest being immediately covered with sacks for two or three minutes. The sacks should then be quickly removed, and the carbon bisulphide

exploded by means of a light attached to a stick at least 3–4 ft. long. If the light is applied too soon, only a quiet burning takes place and the galleries are not shattered. The explosion is not complete for some minutes, but after about five minutes the sacks should be replaced in order to retain the fumes and so kill any ants that are not directly killed by the explosion. The best results are obtained when the work is done in the late afternoon, when the greatest number of ants is present in the nest. It is estimated that the cost of using calcium cyanide dust would be about one-fifth of that of carbon bisulphide if suitable means were available for injecting the dust, but the best cheap available means (a hand blow gun and a dust gun) were not efficient except for the smallest nests. Results indicate that the quantity of dust necessary would be very small. Hot tar proved quite ineffective ; it merely blocked entrance holes and passages, and the surviving adult workers made new openings to the galleries. Kerosene kills the ants with which it comes into contact, but too large a quantity would be necessary to allow of its general use. There was no indication that paradichlorobenzene in fairly heavy dosages destroyed or even irritated the ants. When it is merely necessary to make the ants move from one particular spot, grass or chips spread fairly thickly over the mound, or hot or cold water poured into the nests daily for a few days, irritate the ants sufficiently to make them build a new nest elsewhere.

Newman (L. J.). **Climbing Cut-worm or Tomato Moth** (*Chloridea obsoleta*).—*J. Dept. Agric. W. Aust.*, v, no. 4, pp. 423–426. Perth, W.A., December 1928.

Heliothis (*Chloridea*) *obsoleta*, F., which has been recorded for the past 30 years as a pest in Western Australia, has recently been unusually prevalent there on a variety of cultivated plants and weeds. All stages are briefly described, and notes on the life-history are given. Several generations occur each year, the most important being the spring one, which appears about mid-August or early September in the north, and in October or even November in the southern districts. When the weed food-plants of the cutworm dry up, the larvae migrate to cultivated green crops, tomatos being particularly attacked.

The chief factors in the control of *H. obsoleta* are well-prepared land and proper cultural methods. Tomatos should be staked or trellised to allow of this and of the application of insecticides as a supplementary measure. Those recommended include a combined fungicide and insecticide consisting of ½ lb. lead arsenate powder to 16 gallons Bordeaux or Burgundy mixture and a spray of 2½ lb. paste lead arsenate, 3 lb. molasses and 50 gals. water. As the eggs are deposited on the leaves, on which the newly hatched larvae remain 2 or 3 days before attacking any part of the stem or young fruits, it is advisable to apply arsenical sprays to foliage and green fruits. No insecticide need be used before 1st August, provided that the land planted has been kept under clean fallow, and applications may be made at intervals of 10 days until within 3 weeks of the fruits becoming ripe. No sprays or dusts should be applied after the fruit has started to colour. Maize may be grown as a trap crop among tomatos, but it must be taken out and used as fodder as soon as the silking stage of the cob has been reached.

Abbott (E. V.) & Wolcott (G. N.). **Mosaic of Sugar-cane in Peru.**—*Science*, lxix, no. 1788, p. 381. New York, N.Y., 5th April 1929.

Sipha flava, Forbes, is present on sugar-cane throughout the northern valleys of Peru, being most abundant on the Bourbon, or white cane, and also occurring on lemon grass, though it has never been observed to be sufficiently common to cause appreciable damage to the crop. As it occurs on the tips of the leaves, it cannot be connected with the transmission of the virus of the mosaic disease of sugar-cane. *Aphis maidis*, Fitch, occurs on various grasses in cane fields in all parts of Peru, and also on *Arundo donax*, which commonly grows along ditch banks in the cane fields. The extensive distribution of this Aphid, the known vector of mosaic disease of sugar-cane, emphasises the importance of the prompt elimination of all stools of infected cane and the futility of the steps, already being enforced on some plantations, to prohibit the growing of maize. It is not the Aphids that occur on this plant that are primarily instrumental in transmitting mosaic disease of sugar-cane, but those on grasses in the cane fields, which are forced to feed on the cane when the aerial portions of the grasses are destroyed in the course of cultivation.

[Skeete (C. C.).] **Entomological Notes.**—*Rep. Dept. Agric. Barbados 1927–28*, pp. 20–21. [Bridgetown] 1929.

Diatraea saccharalis, F., probably causes the greatest loss to the sugar-cane industry in Barbados. Two thousand parasites of the larvae, about 95 per cent. of which were *Ipobracon grenadensis*, Ashm., and the remainder *Microdus* sp., were imported from British Guiana during May–July 1927. About 1,600 survived the voyage, and most of these were liberated in experimental cane-fields. By October and November, which were rainy, many could be seen feeding in the early mornings on the leaves of *Cordia interrupta* and on scale-infested guava on the borders of the fields. These parasites decreased in the dry season, and by the end of March none could be observed. During the year over 10,000 plants of *C. interrupta* were distributed to plantations in all parts of the Island.

The Pyralid, *Hypsipyla robusta*, Mo., the caterpillars of which bore the shoots of mahogany (*Swietenia mahagoni*) and *Cedrela toona* in the Punjab, generally appears in Barbados in June. The damage is very characteristic, each shoot dying back from the tip. The method used for its control was the cutting back of the affected twigs and the tarring of the cut surfaces.

Memoria de los trabajos desarrollados por la Oficina Federal para la Defensa Agrícola del 1° de Enero de 1927 al 30 de Noviembre de 1928. [Statement of the Work done by the Federal Bureau for Agricultural Defence from 1st January 1927 to 30th November 1928.] —127 pp., 20 figs. S. Jacinto, D. F., Oficina fed. Defensa agríc., 1928.

An account is given of the activities of the reorganised Mexican Federal Bureau for Agricultural Defence from 1st January 1927 to 30th November 1928. Most of the information on the insect pests has been noticed from the publications of the department. The various regulations concerned with plant protection are appended.

Fleury (A. C.). **Controlling Plant Pest Spread.**—*Mon. Bull. California Dept. Agric.*, xviii, no. 1, pp. 41–48. Sacramento, Cal., January 1929.

The author discusses the spread of insect pests and diseases of plants by natural and artificial means, and the measures that have been taken to prevent or retard their further distribution, pointing out the necessity for a careful comparison of the losses likely to be caused by the pest with those that will be produced by the inconvenience of restricted transport, before any quarantine regulations are promulgated.

Lewis (H. C.). **The Bean Thrips on Pears.**—*Mon. Bull. California Dept. Agric.*, xviii, no. 1, pp. 52–58, 4 figs. Sacramento, Cal., January 1929.

During the past few years considerable damage has been caused by *Heliothrips fasciatus*, Perg. (bean thrips) to pears in the mountain valleys of northern California. The climate in this region is characterised by long dry and hot summers with rather cool nights and day temperatures that are commonly above 90° F. The pear orchards, which are not usually irrigated, become quite dry, and all weeds and grasses dry up completely.

H. fasciatus, of which the adults and larvae are very briefly described, occurs generally over California and other western States ; it is believed to be indigenous to this part of the country and to have spread eastwards. It attacks a large number of cultivated plants and weeds, of which the wild spiny lettuce (*Lactuca scariola*), which is common in orchards and along roadsides, appears to be preferred to all others. Young orchards seem to be much more susceptible to attack than those more than 12–15 years old, and some varieties of pear are apparently more susceptible than others. Both fruit and foliage are attacked by the adults and larvae, which puncture the skin and suck the juices. During July, August and September they increase rapidly, the leaves are drained of sap, turn brown or black, and dry up, and the thrips move on to new and more tender foliage. In this way entire trees have been practically defoliated ; moreover, they are undoubtedly devitalised, and the fruit production of the following season is reduced. The ripening fruit is scarred and rendered unfit for export ; in one case it was estimated that 75 per cent. of the fruit was injured.

Much of the information concerning the distribution and bionomics of this thrips has been taken from an earlier source. In one locality there are seven generations a year, but in Imperial Valley, where the prevailing temperatures are higher, there are 12–14, and at extreme summer temperatures the life-cycle occupies only 10–12½ days. During the autumn, activity diminishes, larvae become less numerous, and the adults begin to hibernate under leaves and in rubbish. In the spring the adults gradually emerge, reproduction and spread taking place very slowly at first. Eggs are deposited in holes in the leaf tissue. In one case a female oviposited for 46 days and laid 134 eggs, but the average number is probably much less. The length of the egg stage may vary from 4–5 days at extremely high temperatures to 17–20 days at an average mean temperature of 59·1° F. The larval stage may last 4½–5 days at extreme temperatures and 17–19 days at an average mean temperature of 65·5° F. The prepupal and pupal stages combined occupy 2–3 days at the extreme temperatures of Imperial

Valley and 17 days at an average mean temperature of 59·2° F. On pears the thrips first appear in numbers on the lower parts of the trees and gradually spread upwards to the tips of the branches as the season progresses.

No entirely satisfactory control has been discovered, but a combination of oil and nicotine has proved fairly effective when thoroughly applied, both the adults and larvae being killed when hit by the spray. The formula is as follows: 1 U.S. gal. light neutral white oil emulsion, ½ U.S. pt. nicotine sulphate, ½ lb. casein spreader, ½ lb. hydrated lime and 100 U.S. gals. water. It is advisable to use 4–5 U.S. gals. to each six-year old pear tree and to maintain a pressure of about 300 lb. at the pump. The casein spreader and the lime may not be necessary, but in some cases at least they ensure the proper liberation of nicotine, which must be obtained because the oil alone is not effective and probably serves mainly as a carrier for the nicotine. Spraying should be begun when the adult thrips appear in numbers in early summer, and if re-infestation takes place from eggs in the leaf tissue (or otherwise), a second spray should be applied in ten days' or two weeks' time. Numerous other spray combinations were tested, but light miscible oils or any form of sulphur injured the fruit, and fish-oil soap, various forms of pyrethrum, and neutral white oil emulsions at 2 per cent. strength proved ineffective. The removal of all wild lettuce from the orchards and adjoining roadsides is recommended.

HANSEN (H. N.). **Thrips as Carriers of Fig-decaying Organisms.**—*Science*, lxix, no. 1787, pp. 356–357, 2 refs. New York, N.Y., 29th March 1929.

Various forms of decay in figs caused by cryptogamic organisms carried by various insects have caused increasing losses of late years in California [*R.A.E.*, A, xvi, 319]. As a result of an examination in May 1928 of several thousand uncaprified, hard, green figs of four varieties from various parts of California, more than 20 per cent. were found infested with *Thrips tabaci*, Lind., and a species of *Frankliniella*. Each of 200 figs showing evidence of insect invasion and cultured to determine their cryptogamic flora yielded one or more of various fig-decaying organisms. Ten figs showing no evidence of insects yielded no cryptogamic flora in culture. It is possible that the early start of decay and fermentation in figs infested with thrips, giving rise to scents very attractive to *Carpophilus hemipterus*, L., and *Drosophila*, is partly responsible for the appearance of these insects when the fruit begins to mature.

GROSSMAN (E. F.). **Control of the Cotton Boll Weevil by Insect Enemies.**—*Science*, lxix, no. 1787, pp. 361–362, 1 ref. New York, N.Y., 29th March 1929.

In the United States, *Anthonomus grandis*, Boh., has about 55 insect enemies, including parasites and predators, all of which are indigenous and were present in the cotton zone before the weevil, which was established in the entire zone by 1922, was introduced. They attack 52 other weevils feeding on 91 other species of plants. Since 1923 there appears to be a lessening of damage to cotton caused by the boll weevil, though severe local infestations have occurred. In the author's

opinion, a more extensive study of its natural enemies will indicate that they are generally becoming more important in limiting the damage done.

Insect Pest Control aided by Research.—*Bull. Wisconsin Agric. Expt. Sta.*, no. 405, pp. 117–121, 2 figs. Madison, Wis., February 1929.

As Wisconsin tobacco is largely used for cigars, insects that damage the leaves must be completely controlled wherever possible. Poison bait should be spread for grasshoppers before the immature stages have grown large enough to move far. Cutworms are also troublesome; to discover their presence cut green lucerne is spread over the ground before planting, and if, by the next morning, it shows evidence of attack, poison bran or lucerne sprayed with lead arsenate is spread over the field. *Hylemyia antiqua*, Mg. (onion maggot) and to a less extent *Eumerus strigatus*, Fall. (lesser bulb fly) damage onions; baits for them have proved ineffective, and though insecticides may kill the eggs and young larvae, none has been found that can be depended upon to kill the larger ones. Observations on *Phorbia* (*Chortophila*) *brassicae*, Bch. (cabbage maggot) have shown that the females oviposit on the oldest and largest cabbage plants available, and these are preferred to young radishes or turnips, which have been recommended as trap crops.

It is now possible to forecast to a large extent outbreaks of *Myzus cerasi*, F. (cherry aphis). Conditions favourable to the Aphid are dry weather in late August and September, when the autumn migrants return to cherry from the alternate food-plant (usually pepper grass [*Lepidium*]), and warm weather during September and October, which ensures fertilisation of the females. Alternate freezing and thawing in winter is detrimental to the eggs, and late frosts in spring destroy many eggs that have begun development, as well as recently hatched young. Prolonged, heavy spring rains wash many Aphids from the trees. Contact sprays, such as nicotine sulphate or derrisol should be applied early in the season, before the leaves unfold; in infested orchards a pre-blossom spray is needed if control is to be satisfactory.

In 1928, several species of Chrysomelid beetles appeared suddenly about 1st June in overwhelming numbers, attacking willows and other trees, shrubs, farm crops, vegetables, flowers and weeds, large trees being completely defoliated in one or two days. A second generation appeared about mid-August, but was confined almost entirely to willows. While the possibility of aeroplane dusting was being discussed, the beetles disappeared as suddenly as they had come, probably hibernating in the ground or under leaves and rubbish.

Mutchler (A. J.) & Weiss (H. B.). **The Ostomidae of New Jersey.**—*Circ. New Jersey Dept. Agric.*, no. 154, 17 pp., 1 pl., 3 figs., 21 refs. Trenton, N.J., January 1929.

Brief notes are given on those species of the family Cucujidae (Ostomidae) that occur in New Jersey, some of which are known to be predacious. A full account is given of *Tenebroides mauritanicus*, L., the only species that appears to be of economic importance [*R.A.E.*, A, xv, 190], and keys to the subfamilies, genera and species are appended.

PAPERS NOTICED BY TITLE ONLY.

PETHERBRIDGE (F. R.). **The Common Green Capsid Bug** [*Lygus pabulinus*, L.].—*J. Minist. Agric.*, xxxv, no. 12, pp. 1133–1140, 2 pls., 3 figs., 1 ref. London, March 1929. [*cf. R.A.E.*, A, xvi, 619.]

[YAZUIKOV (A.). (ZAKHVATKIN, A. A.).] **Языков (А.). (Захваткин, А. А.). The Biology and Morphology of the Parasites of the Egg-pods of Acrididae in Central Asia. 1. Description of the Triungulin of** *Epicauta erythrocephala*, **Pall. (Col., Meloidae).** [*In Russian.*]—*Uzbekistan Expt. Plant Prot. Sta.* [Pubn.] no. 15, 7 pp., 9 figs., 2 refs. Tashkent, January 1929.

BONDAR (G.). **Uma praga do amendoim,** *Parastega* (*Gelechia*) *bosquella* **Chambers.** [*Stegasta bosquella*, a Pest of Ground-nuts.]—*Correio agric.*, vi, no. 10, pp. 224–225. Bahia, October 1928. [See *R.A.E.*, A, xvii, 159.]

BONDAR (G.). **Séria praga do repolho na Bahia,** *Plutella maculipennis* **Curtis.** [*P. maculipennis*, a serious Pest of Cabbage in Bahia.]—*Correio agric.*, vi, no. 11–12, pp. 259–260, 1 fig. Bahia, November–December 1928. [See *R.A.E.*, A, xvii, 233.]

BONDAR (G.). **A broca do tomateiro,** *Phyrdenus divergens* **Champ.** [The Tomato Borer, *P. divergens*, Germ.]—*Bol. Agric.*, xxix, no. 9–10, pp. 590–595, 3 figs. S. Paulo, September–October 1928. [See *R.A.E.*, A, xvii, p. 45.]

LOPEZ (A. W.). **Morphological Studies of the Head and Mouthparts of the Mature Codling-moth Larva** *Cydia* (*Carpocapsa*) *pomonella* **(Linn.).**—*Univ. Calif. Pub. Ent.*, v, no. 3, pp. 19–36, 16 figs. Berkeley, Cal., 1929.

EGGERS (H.). **Eine neue Ipidengattung (Col.) aus Nordamerika** [*Sphaerosinus striatus*, gen. et sp. n.]—*Tijdschr. Ent.*, lxxii, no. 1, pp. 40–41. Amsterdam, 15th April 1929.

BÖVING (A. G.). **Beetle Larvae of the Subfamily Galerucinae.**—*Proc. U.S. Nat. Mus.*, lxxv, art. 2, 48 pp., 5 pls., 3 figs. Washington [D.C.], 1929.

COTTON (R. T.). **The Larva of the Weevil** *Diaprepes* (*Exophthalmus*) *quadrivittatus* **Olivier (Coleoptera: Rhynchophoridae).**—*Proc. Ent Soc. Wash.*, xxxi, no. 2, pp. 27–31, 1 fig., 1 ref. Washington, D.C., February 1929.

CLAUSEN (C. P.). **Biological Studies on** *Poecilogonalos thwaitesii* **(Westw.), parasitic in the Cocoons of** *Henicospilus* **(Hymen.: Trigonalidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 4, pp. 67–79, 1 pl., 1 fig. Washington, D.C., April 1929.

GILLETTE (C. P.) & PALMER (M. A.). **New Colorado Aphididae.**—*Ann. Ent. Soc. Amer.*, xxii, no. 1, pp. 1–32, 8 pls. Columbus, Ohio, March 1929.

MORRISON (H.). **Some Neotropical Scale Insects associated with Ants (Hemiptera-Coccidae)** [1 new genus, 9 new species].—*Ann Ent. Soc. Amer.*, xxii, no. 1, pp. 33–60, 9 figs., 10 refs. Columbus, Ohio, March 1929.

GREEN (E. E.). **Some Coccidae collected by Dr. J. G. Myers in New Zealand.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 369–389, 14 figs. London, March 1929.

Injurious Insects and other Pests.—*Rep. Kansas Agric. Expt. Sta. 1926–28*, pp. 67–82. Manhattan, Kans., 1928.

A study of insect abundance in comparison with climatic conditions shows that precipitation is a much more important factor than temperature, as it affects the insect directly, controls the growth of the plants on which it feeds, and has an important influence on fungous and bacterial diseases.

The Hessian fly [*Mayetiola destructor*, Say] has spread westward, with the increased planting of wheat in western Kansas, and the loss caused by it during 1927 was estimated at 20,000,000 bushels. There were three distinct broods in 1926 and five broods in 1927, when the fly emerged earlier and was present later than in any season for the past 20 years. A summary of the results of 20 years' experiments on the time of planting wheat to escape damage by this fly indicates that it may be planted somewhat earlier than the dates hitherto recommended. Studies indicate that a considerable amount of damage caused by the chinch bug [*Blissus leucopterus*, Say] can be prevented by proper cultural practices. In the preparation of seedbeds for wheat, the bugs concentrated in those plots that were disked at seeding time or ploughed shallowly in September, whereas they were comparatively scarce in those that were deeply cultivated early. Fields that had been ploughed early were also less damaged than fields ploughed later. In observations on the migration of overwintering adults to small grains in spring, it was found that barley was the most infested, relatively little injury being suffered by oats and most varieties of wheat.

Investigation into the feeding requirements of insects infesting stored grain, such as the confused flour beetle [*Tribolium confusum*, Duv.], the saw-tooth grain beetle [*Silvanus surinamensis*, L.] and the cadelle [*Tenebroides mauritanicus*, L.], showed that they can be used for testing the nutritive value of food. The most indispensable constituents of the diet of the insects mentioned appeared to be vitamins A and B. A well-balanced protein is not necessary, and the mineral requirement is low. Grain insects apparently select their food on the basis of nutritive value, size of particle, and physical texture.

An outbreak of the true army worm [*Cirphis unipuncta*, Haw.] occurred on wheat in the spring of 1927. Experiments in which plantings of maize were made at intervals of 10 days throughout April and May showed that damage by the corn earworm [*Heliothis obsoleta*, F.] decreased with delay in planting, maize planted about 1st May escaping with the minimum amount of injury. The heaviest infestations of wireworms and cutworms occurred in fields that had been planted with wheat in the previous year and with oats prior to the wheat. Very little damage was caused in fields where small grains had only been grown for one year or where maize had been planted continuously. A severe outbreak of *Papaipema* [*nitela*, Gn.] (common stalk borer) occurred on maize in 1927. Approximately 40 per cent. of the stalks had fallen before harvest, the root systems were badly damaged and the yield considerably decreased.

Early in the summer of 1926, *Haltica foliacea*, Lec., caused considerable damage to apple stock in nurseries and to young orchards. This beetle may be controlled by a spray of 5–6 lb. lead arsenate to 50 U.S. gals. water or by Bordeaux mixture (4 : 4 : 50), which acts as a repellent. The diamond-back moth [*Plutella maculipennis*, Curt.]

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has become a pest of cabbages in one locality, eating into the heads and making them unsaleable. It may be controlled by using 2 lb. lead arsenate to 50 U.S. gals. water, with 2 lb. resin soap as an adhesive. The seed corn maggot [*Phorbia cilicrura*, Rond.] caused serious losses on transplanted cabbages in the spring of 1927. Injury by this insect is directly associated with organic refuse and fertiliser, and there appears to be less damage to transplanted cabbage if the manure is applied and worked into the soil during the previous autumn. Three years' work on the life-history of the southern corn root worm [*Diabrotica duodecimpunctata*, Ol.] on *Sorghum* show that the average length of the egg stage is 7·9 days, of the larval stage 30·7 days and of the pupal stage 12·1 days. In 1926 larvae hatching from eggs laid in May and June required an average of 11 days more to complete their growth than those hatching from eggs laid in July and August. Laboratory tests indicate that click beetles [Elaterids] are attracted to a bait of bran, honey and sodium arsenite and are readily killed by it. They are also attracted to syrups, honey, exuding sap, watermelon pulp and other sweet substances. Tests with soil insecticides have shown that many of them, particularly the sodium compounds, are injurious to the soil, and that arsenic compounds, particularly calcium arsenate, are very deleterious to the plants, tending to retard root development.

The life-cycle of the Tortricid, *Tortrix pallorana*, Rob., on lucerne lasts 31–47 days. It occurs from July to September, but is usually most abundant during June and July. The eggs are laid in masses on the leaves, and the larvae feed within a shelter made by loosely webbing a few of the leaves together. *Empoasca fabae*, Harr., which is capable of causing severe injury to lucerne, was exceedingly abundant in fields during early August. During September and October 1927 there was a small outbreak of *Laphygma frugiperda*, S. & A. (fall army worm), but the injury was confined largely to the bent grasses, lawns suffering most, and in only a few cases was damage to lucerne reported. During the spring of 1928 the pea aphis [*Macrosiphum pisi*, Kalt.] was again abundant in the eastern part of the State. Harrowing gave no perceptible results as a means of control; severe brush-dragging injured young lucerne, and although it killed large numbers of the smaller Aphids, the larger nymphs and adults escaped, and it was therefore considered unsatisfactory. The only effective and economic control measures are the use of calcium cyanide in patches in the early spring and of an aphidozer when the Aphids have spread over the whole field. A number of individuals of the Chalcid, *Pteromalus eurymi*, Gahan, emerged from a pupa of the alfalfa caterpillar [*Colias eurytheme*, Boisd.].

Observations made on banded shade trees indicate that the majority of the adults of the fall cankerworm [*Alsophila pometaria*, Harr.] do not emerge until the latter part of January and the first part of February. The adults of the spring cankerworm [*Palaeacrita vernata*, Peck] emerge during the latter part of February and in March. In late May and June 1927 the larvae of *Blepharida rhois*, Forst. (sumac flea-beetle) were found defoliating smoke bush (*Rhus cotinus*). Hibernation takes place within a few inches of the food-plant and only one or two inches below the surface of the ground.

In experiments with the codling moth [*Cydia pomonella*, L.] it was found that the light breeze in a cage caused by a ventilating fan was sufficient to prevent oviposition, which took place readily after sunset when there was no perceptible breeze. These observations

were corroborated in the field, when it was found that the moths oviposit after sunset on still evenings ; oviposition did not occur if the temperature in early evening was below 65° F. Tests were made with numerous insecticides against *C. pomonella*, but none proved as effective as lead arsenate alone. In banding experiments on apple trees burlap bands were most effective ; a mixture of oil and beta-naphthol was the best material for treating the bands and gave a mortality of 85 per cent.

Hodgson (B. E.). **The Host Plants of the European Corn Borer in New England.**—*Tech. Bull. U.S. Dept. Agric.*, no. 77, 63 pp., 34 figs., 8 tables, 8 refs. Washington, D.C., November 1928.

This bulletin is limited to a study of *Pyrausta nubilalis*, Hb., as it occurs in New England, where there are two generations a year. A list is given of its food-plants, arranged in systematic order, and shows their status, parts attacked, relative frequency of infestation and the generations and stages of the insect found on each.

Seventy-five kinds of plants are attacked by the larvae of both generations, 25 by those of the first generation only and 119 by those of the second only. Plants infested by a single generation are usually either of rare occurrence or infrequently attacked, the others being chiefly infested by the second generation, which is normally more numerous and more generally distributed than the first. Many plants are not attacked by the first generation because they are either too small or too immature to be attractive to ovipositing moths ; with the second generation, egg masses are more numerous on younger plants. Infestation is also influenced by the frequency and distribution of the plants, their characteristics and environment. All food-plants, especially weeds growing on dumps and other waste places, or associated with cultivated crops, may harbour the pest and become sources of infestation. Hibernation often occurs in maize stubble and garden refuse.

Jones (D. W.). **Imported Parasites of the European Corn Borer in America.**—*Tech. Bull. U.S. Dept. Agric.*, no. 98, 27 pp., 24 figs., 5 refs. Washington, D.C., January 1929.

An annotated list is given of the more important parasites introduced from Europe for the control of *Pyrausta nubilalis*, Hb. (European corn borer), together with an account of the technique used in breeding two of the species, much of the information being contained in papers already noticed [*R.A.E.*, A, xiv, 289 ; xvii, 94, 215, etc.].

In order to secure hosts for parasitism by *Microgaster tibialis*, Nees, *Apanteles thompsoni*, Lyle, and other species that require immature larvae, adults of *P. nubilalis* are put into cages lined with wire gauze, with wet cotton kept on the floor to provide the necessary moisture. The moths oviposit on sheets of waxed paper inserted through narrow slits in the roof of the cage, but not on the cage or wet cotton. The papers with eggs on them are removed each morning and kept warm in a very moist chamber. In three days, when the eggs are ready to hatch, the papers are cut into pieces having about 60 eggs on

each, and these are placed in a 2-inch vial closed with a cotton plug, with a third of a string bean enclosed as food for the resulting larvae. By the time the food should be renewed the larvae have reached the second instar and are ready for parasitism. The cotton plugs are removed and the vials so placed that the larvae, which are most of them ready to leave the food and migrate, move of their own accord toward the light into a glass-backed cage, whence they are easily removed.

It was found difficult to induce mating with *Microgaster tibialis*, and as without fertilisation males only are produced, this was an important point in their breeding. Uniform success at unseasonable times was not obtained until the sexes were separated and allowed to come together in a large cheese-cloth cage at a temperature of 64° F. Other things being equal, mating took place more readily at this temperature than at temperatures 2° higher or lower. Ninety per cent. of the individuals often mate within a few minutes ; the mated females are then caught in vials for breeding work, and the unmated adults are separated and kept apart until the next day. Practically all females mate within three days under these conditions. The fertilised females are kept in small cages with glass fronts and removable wire gauze backs. From 10 to 15 are kept in each cage with loaf sugar for food and a piece of wet cotton for moisture. Except for short periods for feeding or oviposition, the cages are kept in a cool dark closet. Parasitism is secured rapidly by placing small larvae in the cage and removing them as soon as an egg is deposited. The floors of the cages are smoothly coated with black enamel to facilitate picking up the parasitised larvae. Cannibalism occurs among larvae of *P. nubilalis*, and they are therefore isolated in small glass vials with copper gauze tops with a section of string bean, changed every five days, to serve as food. The trays containing the vials are kept in an incubator closet.

Cocoons of *Apanteles thompsoni* must be kept with a constant but limited supply of moisture, and it was found that emergence was much more satisfactory when the cocoons were kept in a vial with a string bean, which constantly gives off a small quantity of moisture, than when they were kept with or on various media artificially moistened. Only females have been secured up to the present, and these are very delicate. Each day they are brought into ordinary room conditions, fed and allowed to oviposit once in a larva of the third instar or larger (from 8–40 eggs are inserted) and returned to a cool, dark closet; in this way they are kept alive for 3–4 weeks. The parasitised larvae are afterwards handled in the same way as those parasitised by *Microgaster*.

Lawson (P. B.). **A Leafhopper Parasite**—*Polynema saga* (**Girault**). (**Hymenoptera, Mymaridae**).—*Ann. Ent. Soc. Amer.*, xxii, no. 1, p. 130. Columbus, Ohio, March 1929.

The Mymarid parasite, *Polynema saga*, Gir., which has hitherto been known only from the type specimen in the United States National Museum, has been taken in numbers in Kansas from the leafhopper, *Euscelis stactogalus*, Fieb., on tamarix bushes, where it was parasitising over 90 per cent. of the overwintering eggs. It will probably be found wherever this Jassid is abundant.

Sweetman (H. L.). **Precipitation and Irrigation as Factors in the Distribution of the Mexican Bean Beetle, *Epilachna corrupta* Muls.**—*Ecology*, x, no. 2, pp. 228–244, 17 graphs, 25 refs. Brooklyn, N.Y., April 1929.

The following is taken from the author's summary :—

This paper gives the results of a study of moisture as an ecological factor in the life of *Epilachna corrupta*, Muls. The native habitat of this beetle has a very wet climate during the summer, and it is a serious pest in the eastern United States, where precipitation is heavy. In the western States, infestation is largely confined to areas where the fields are irrigated, being rare and only occasionally injurious in other sections. The fact that drought periods in the east are nearly as disastrous to the bean beetle as normal precipitation in the dry-farm areas in the west is also suggestive of a high moisture requirement on the part of the insect. This is apparently true of all its stages and during the entire year. These conclusions are in direct contradiction to those of Graf [*R.A.E.*, A, xiii, 246].

Wilson (A.). **Insects and their Control.**—Large Cr. 8vo, 342 pp., 184 figs. New Brunswick, N.J., A. Wilson, Inc., 1929.

A concise account is given of the commoner insects found in orchards and gardens, on vegetables, flowers, ornamental plants, shrubs and trees in the United States, with brief notes on their life-history and control. Only popular names are given, and the insecticides recommended include products manufactured by the author's company wherever these are considered satisfactory.

Quarantine on account of the Asiatic Beetle and the Asiatic Garden Beetle. Notice of Quarantine no. 66, with supplemental Rules and Regulations.—*P.Q.C.A.*, no. 61, 8 pp., 1 map. Washington, D.C., U.S. Dept. Agric., March 1929.

The States of Connecticut, New Jersey, New York, Pennsylvania and Virginia and the District of Columbia are quarantined to prevent the spread of *Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow, as from 15th March 1929. Plants, sand, soil, peat, manure, etc., may be moved from the quarantined area into or through any other State only in accordance with prescribed regulations.

Diehl (H. C.), Fisher (D. F.), Hartman (H.), Magness (J. R.) & Robinson (R. H.). **Removal of Spray Residue from Apples and Pears in the Pacific Northwest.**—*Circ. U.S. Dept. Agric.*, no. 59, 19 pp. Washington, D.C., January 1929.

This circular has been prepared in co-operation by the authors from the results of their independent investigations, most of which have been previously noticed [*R.A.E.*, A, xvi, 25, 597, 598, 601, 646].

Hough (W. S.). **Studies of the relative Resistance to Arsenical Poisoning of different Strains of Codling-moth Larvae.**—*J. Agric. Res.*, xxxviii, no. 4, pp. 245–256, 1 fig., 4 refs. Washington, D.C., 15th February 1929.

Experiments to compare the resistance to lead arsenate of larvae of different strains of *Cydia* (*Carpocapsa*) *pomonella*, L., have been

continued [*R.A.E.*, A, xvi, 514]. Since the larvae were tested under the same conditions in Virginia, it was assumed that the direct influence of a different climate would disappear and the effect of parasites and predators as a factor was eliminated in the insectary, so that any differences observed between the strains would depend on differences in the larvae themselves. The results confirmed those already obtained [*loc. cit.*] in that the Colorado strain consistently showed a marked superiority over the Virginia strain, both in the proportion of surviving larvae and in the number of obvious side injuries produced on sprayed apples. On unsprayed fruit a similar but less marked superiority in the Colorado strain was shown. Moreover, larvae of this strain from ancestors living under the climatic conditions of Virginia since April 1927, were as successful as those from parents that had passed only the winter in Virginia. In cross-breeding experiments in 1928 there was an indication of a slight superiority of the cross between Colorado males and Virginia females over the reverse cross in the second generation.

Comparative tests carried out both at Yakima, Washington, and Winchester, Virginia, with larvae from parents from Washington State indicate that they are similar to the Colorado-Virginia crosses in their ability to enter and injure sprayed fruit, being considerably inferior to the Colorado larvae, but slightly superior to the Virginia larvae. When allowed to attack apples sprayed with lead arsenate (2 lb. to 100 U.S. gals.), the Virginia larvae were not very different in their behaviour at Yakima and Winchester.

It is therefore concluded that there are strains of *C. pomonella* that differ in their ability to enter and injure apples sprayed with an arsenical. No morphological differences have been discovered, and evidence indicates that the essential difference is within the larvae. Whatever the nature of the difference may be, it is transmitted to the next generation, and the progeny from crossing two strains differs from both parents through at least two generations. The number of arsenical sprays recommended in Washington is intermediate between the numbers recommended for Colorado and Virginia, the number of sprays increasing in each State with the increasing resistance of its strain of the moth. It is possible that spraying with arsenicals has been carried on with sufficient intensity and long enough to result in the artificial selection of the more hardy individuals that now exist as superior strains, especially as, in these three States, heavy spraying with arsenicals was first begun in Colorado and most recently taken up in Virginia. Another suggestion is that the superior strains developed independently of the spraying, and that the increased use of arsenicals is the result, rather than the cause, of their origin.

HERRICK (G. W.). **Some Insect Problems, Present and Future, of the Fruit Grower.**—*Proc. New York St. Hort. Soc.*, lxxiv, pp. 4–15. Le Roy, N.Y., 1929.

Somewhat popular accounts are given of the following actual and potential pests that occur in New York : *Hemerophila pariana*, Clerck (apple and thorn skeletoniser), *Paratetranychus pilosus*, C. & F. (European red mite), cherry fruit-flies [*Rhagoletis cingulata*, Lw., and *R. fausta*, O.S.], *Rhagoletis pomonella*, Walsh (apple maggot), *Cydia*

(*Laspeyresia*) *molesta*, Busck (oriental peach moth), *Popillia japonica*, Newm. (Japanese beetle) and *Anomala orientalis*, Waterh. (Asiatic beetle).

Mundinger (F. G.). **Report on some Entomological Investigations in the Hudson Valley.**—*Proc. New York St. Hort. Soc.*, lxxiv, pp. 164–167. Le Roy, N.Y., 1929.

Investigations on the pear midge [*Contarinia pyrivora*, Riley] were continued [*cf. R.A.E.*, A, xv, 425]. In 1928 the adults began to emerge on 24th April. The cluster buds had not separated and the weather was cold. The midges increased in numbers, however, and were found resting on the bark of the lower parts of the trees. The cluster buds did not separate until 3rd May, pink showed by 7th May and full-bloom occurred about 11th May when the last midge was taken from the cages. In the field no fly was observed on a cluster bud before pink was visible and during three years' investigations not a single fly has been seen on a blossom ; it therefore appears that the critical time for oviposition is between the separating of the cluster buds and the late pink. Various sprays were applied on 3rd and 7th May and the results are shown in a table. Sprays containing nicotine or miscible oil appear the most satisfactory. It would seem to be advisable to keep the trunks and lower branches covered with spray to kill or repel the flies that may be resting there.

During 1928 adults of the apple maggot [*Rhagoletis pomonella*, Walsh] emerged from 27th June to 6th September, with a maximum between 12th and 24th July. In 1926 and 1927 the maximums occurred between 17th and 27th July and between 17th and 26th July respectively. In these years climatic conditions differed, but the periods of maximum emergence almost coincided, and it therefore seems probable that the maximum emergence may be regularly anticipated between 15th–27th July.

Herrick (G. W.) & Griswold (G. H.). **The Fumigation of Greenhouses to destroy Insect Pests.**—*Bull. Cornell Agric. Expt. Sta.*, no. 474, 20 pp., 11 figs., 8 refs. Ithaca, N.Y., February 1929.

Information is given on the methods of fumigating greenhouses with nicotine products (both in liquid and powder forms) against Aphids, and with calcium cyanide against Aleurodids, Coccids and other pests. The amount of fumigant to be used and the precautions to be observed are also discussed.

Lawson (P. B.). **Leafhopper and the Trap Light.**—*J. Kansas Ent. Soc.*, ii, no. 2, pp. 39–47, 1 graph. McPherson, Kans., April 1929.

The observations described were made at Lawrence, Kansas, during the season of 1928. A 200-watt Mazda bulb was suspended under a suitable shelter, which protected the whole trap. About 6 ins. below the light was a funnel nearly 2 ft. wide that tapered to a tube 4 ins. in diameter and about 18 ins. long, which was divided into three sections ; the lowest was 3 ins. long and contained potassium cyanide in a perforated tin box, the one above, about 6 ins. long, had near its lower end a wire screen of about nine meshes to the inch. On the top of the

funnel was another screen of four meshes to the inch. Most of the insects that fell into the lowest section were leafhoppers, of which 126 species and varieties were taken, an average of over 1,000 a night being captured on 70 nights. A list of the species is given, with notes on the life-histories of some of them, based on data from the catches.

HERMS (W. B.). **The experimental Method as applied to Entomological Investigations.**—*J. Econ. Ent.*, xxii, no. 1, pp. 45–61, 19 refs. Geneva, N.Y., February 1929.

The following is taken from the author's abstract: In order to illustrate the use of the experimental method of investigation, the importance of which in the field of economic entomology is pointed out, experiments are cited on insect nutrition, transmission by insects of plant diseases, insecticides, and light reactions. The use of high grade instruments for observing, recording and regulating such phenomena as temperature, moisture, air movements, evaporation and humidity is strongly urged, and a brief account is given of what the author considers the necessary qualifications of a worker in the field of economic entomology.

CUTRIGHT (C. R.) & HOUSER (J. S.). **A Laboratory Method for determining the Attractiveness of Bands to Codling Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 1, pp. 62–64, 1 fig. Geneva, N.Y., February 1929.

A method designed to eliminate the dissimilar conditions that have hitherto resulted in conflicting statements regarding the efficiency of different types of bands in trapping mature larvae of the codling moth [*Cydia pomonella*, L.] is described. Posts of sawn timber, similar in size, shape and material, are substituted for the trunks of growing trees on which the bands are usually tested, and arranged in pairs in as many series as may be required, placed upright in the soil or mounted on pedestals where the same amount of light is available. The two bands to be compared are then placed on the posts, one about 6 inches from the top and the other about 6 inches lower, the relative positions being reversed on the second post and the base of each post surrounded by a band of adhesive or a box barrier. A given number of larvae that have recently left the fruit is then placed on the top of each post. When these larvae have all taken up permanent positions the total number of larvae found under both bands of each kind are compared. The most uniform outdoor results are secured by liberating the larvae in the evening, and more normal behaviour of larvae is obtained by placing them on the posts a few at a time. By this method differences in the trees, light, moisture or degree of infestation are avoided. Results obtained in tests with wet as compared with dry bands and corrugated cardboard bands treated with beta-naphthol as compared with untreated bands of the same material, as indicated in tables, show that the method is reliably uniform in a series of trials and is adapted for testing any type of band. The bands treated with beta-naphthol caught fewer larvae (average 35·2 per cent. of the total caught) than the untreated ones.

Regan (W. S.). **The unsprayed check Tree as an Indicator of seasonal Codling Moth Activity.**—*J. Econ. Ent.*, xxii, no. 1, pp. 65–71. Geneva, N.Y., February 1929.

A fairly accurate record of larval activity of *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) can be secured throughout the season in connection with control tests by frequent and regular thinning of untreated control trees, which are thus also prevented to a certain extent from becoming a source of infestation. The results of thinning three varieties of unsprayed trees in Washington in 1926, 1927 and 1928 showed "stings" or larvae on 90, 40·6 and 52·2 per cent. of the fruit respectively, the corresponding proportion of apples infested with calyx larvae being about 30, 6·7 and 13 per cent. The variations in the degree of infestation were not in accordance with the reputed susceptibility of the varieties of apple. At each thinning, all apples showing a visible "sting" or infestation were removed, and the numbers removed throughout the season at intervals varying from 10 to 16 days show the extent to which fruit is subjected to continuous attack in moderately to heavily infested districts in the north-west and demonstrate the necessity of a 10–12 day spray schedule to keep the growing fruit covered. Results with the omission of the calyx spray suggest the possibility that this spray may not be as important under conditions prevailing in Washington as is generally supposed.

Herbert (F. B.) & Leonard (M. D.). **Observations on the Oil-Nicotine Combination for the Control of the Codling Moth and other Apple Insects in the Pacific Northwest.**—*J. Econ. Ent.*, xxii, no. 1, pp. 72–78. Geneva, N.Y., February 1929.

Experimental work in the Pacific North-west in 1927 and 1928 indicates that a combination of oil and nicotine gives better results than those obtained with lead arsenate with or without oil in the control of *Cydia* (*Carpocapsa*) *pomonella*, L., and the other more important insect pests of apple. The use of this spray combination also simplified the spray residue problem and frequently resulted in raising the grade of the fruit.

Three orchards sprayed in 1927 with 1 U.S. pt. 40 per cent. nicotine sulphate, 1 U.S. gal. Volck oil and ½ lb. casein spreader in 100 U.S. gals. water, applied in the calyx and in 4, 5 and 8 cover sprays, showed at harvest 13 per cent., 4 per cent., and 4 per cent. apples infested by *C. pomonella* respectively. In the first orchard no spray was applied after 9th July. Trees in this orchard treated with lead arsenate showed 21 per cent. infested fruit.

In 1928 oil or nicotine alone proved slightly inferior to lead arsenate in the control of *C. pomonella*, but when combined they were in general about equal to it, and also usually gave commercial control of mites, San José scale [*Aspidiotus perniciosus*, Comst.] and green aphis [*Aphis pomi*, DeG.] and considerably reduced the numbers of woolly apple aphis [*Eriosoma lanigerum*, Hausm.]. In an orchard that had previously received one calyx and one cover spray of 2 lb. lead arsenate and ½ lb. casein spreader to 100 U.S. gals. water, the employment of ½ U.S. gal. light highly-refined summer oil, 1 U.S. pt. nicotine sulphate and ½ lb. casein to 100 U.S. gals. water for the second and third cover sprays resulted in a reduction of infested fruit from 10–15 per cent. in

1927 to only 3 per cent., as compared with 10·4 per cent. in a plot treated with lead arsenate throughout. The last cover spray was applied on 10th June. Burlap bands applied to the lead-arsenate treated trees proved more attractive than tarred paper bands applied to the others, so that if the same bands had been applied to all the trees the results would have been even more in favour of the nicotine-oil combination. The cost of the nicotine-oil spray per tree per season is estimated at 2*s.* 6*d.* and that of lead arsenate at 1*s.*, but the net increase in the value of the yield from trees treated with nicotine-oil as compared with those treated with lead arsenate is 5*s.* 6*d.* per tree per season. Additional experiments with variations of the number and kind of sprays show equally favourable results.

HERMS (W. B.). **A Field Test of the Effect of artificial Light on the Behaviour of the Codling Moth** *Carpocapsa pomonella* **Linn.**—*J. Econ. Ent.*, xxii, no. 1, pp. 78–88, 5 refs. Geneva, N.Y. February 1929.

An account is given of experiments carried out in California in 1928 to determine the effect of artificial light on *Cydia* (*Carpocapsa*) *pomonella*, L. The following is taken from the author's abstract: Six 500-watt lights were suspended directly over a block of 15 trees. The plot was flooded with light each evening for 2½–3 hours from 26th April to 30th June, *i.e.*, to the end of the first brood of the codling moth. Temperature for the period was recorded, and foot candle meter readings were made to ascertain the intensities. At the end of the test 21 per cent. of the apples on trees outside the test plot were attacked, as compared with 14·5 per cent. on those inside. The light appears to deter the moths from oviposition.

In the discussion that followed E. A. Siegler stated in reply to a suggestion that the lights might be burned to advantage throughout the night that, as *C. pomonella* does not oviposit after 9 p.m., there would be no object in doing this. P. J. Parrott stated that in somewhat similar experiments conducted with light-traps in New York, although 40,000 moths of the leaf-roller [*Tortrix argyrospila*, Walk.] and 60,000 of the bud moth [*Argyroploce variegana*, Hb.] were caught during the season, the resulting benefit was not in proportion to the numbers caught. Trees that had been subjected to illumination continuously throughout the night during the entire growing period were slightly better than the checks, but markedly inferior to those that had been sprayed. Results in comparative tests with bait pails and lights were variable.

HEADLEE (T. J.). **An Operation in practical Control of Codling Moth in a heavily infested District. Third and Final Report.**—*J. Econ. Ent.*, xxii, no. 1, pp. 89–97. Geneva, N.Y., February 1929.

This report, which is the last of three [*R.A.E.*, A, xv, 259; xvii, 79], reviews the results of a three years' co-operative campaign against *Cydia* (*Carpocapsa*) *pomonella*, L., in New Jersey, which has resulted in an increase of over 30 per cent. in fruit free from injury and a decided increase in the total volume of fruit. The average proportion of uninfested fruit in 1928 was almost identical with that in 1927, the

absence of any great increase being attributable to fear of arsenical residues. The efficiency of lead arsenate in preventing calyx infestation was confirmed. During the period of entry by first and second brood larvae, film coatings are far more efficient than spot coatings, but while it is of prime importance to maintain them during the period of entry by the first brood, injury is reduced by only a relatively small percentage by this means during the entry of the second. Dusts, even in split applications, are only half as effective as sprays. The amount of arsenic deposited upon the fruit and foliage in the form of film coating is much more important than the amount of arsenic used per gallon of spray ; 8–10 U.S. gals. spray, containing lead arsenate powder at the rate of 4 lb. to 100 U.S. gals. afford an optimum charge to the fruit and foliage of a tree 25 ft. high by 30 ft. wide. An optimum film coating may be supplied by the use of spreaders of a casein nature (at least 25 per cent.) at the rate of 3 lb. to 100 U.S. gals.

In the blossom fall application, which was timed by the stage of development of the trees, the spray was placed in the outer calyx cup. The first cover spray, which is intended to establish a film coating on fruit and foliage against first brood larvae, was made when one-half of the overwintering moths had emerged, repeated whenever the coating showed signs of breaking, and discontinued when emergence ceased. The first cover spray for second brood larvae was applied, when necessary, one week before half the moths of the first summer generation had emerged, and repeated on the appearance of clear evidence that the film was breaking. In 1928 arsenical dusts were resorted to in controlling second brood larvae in order to avoid spray residues, and this was probably responsible for the failure to obtain an additional 8–10 per cent. increase in the average uninfested fruit in that year.

Measures of orchard sanitation included the prevention of the escape of the overwintered generation from fruit containers and the use of bands. The results of this work indicate the necessity of discovering a method that ensures the destruction of at least 90 per cent. of the overwintering larvae. Examination of two trees enclosed in cages divided into three chambers indicated that 91 per cent. of the overwintering generation of *C. pomonella* comes from the trunk and larger branches in the region covered by rough bark, 9 per cent. from the twigs and branches above the rough bark, and none from the ground under the tree. Experiments indicated that applications of proper amounts of miscible pine tar oil to the rough bark result in the destruction of all larvae wintering therein without apparent injury to the trees. The cost of treating a tree 25 ft. high, for which 1 U.S. qt. pine oil mixed with an equal quantity of water and applied with a sprayer is required, was about 5*d*.

Snapp (O. I.) & Swingle (H. S.). **Preliminary Report on Attrahents for Peach Insects.**— *J. Econ. Ent.*, xxii, no. 1, pp. 98–101. Geneva, N.Y., February 1929.

During the course of a season's work in Georgia, 122 materials were tested in peach orchards, but none was sufficiently attractive to insects attacking peaches to give promise of being of value for control. Notes are given on some that proved slightly attractive to various insects, these including distillates from green peaches or peach bark. The latter and other chemicals with similar odours are unlikely to attract many insects when placed in an orchard where the same odour is being

given off by the trees. An endeavour to overcome this difficulty by using higher concentrations is not likely to prove effective, since many chemicals that are attractive at low concentrations become repellent when used in a more concentrated form.

FROST (S. W.). **Fourth Contribution to a Study of Baits, with special Reference to the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxii, no. 1, pp. 101–108, 1 chart, 1 fig. Geneva, N.Y., February 1929.

In continued studies of baits for the control of *Cydia* (*Laspeyresia*) *molesta*, Busck, carried out in Pennsylvania during 1928 [*cf. R.A.E.*, A, xvi, 516], different syrups, compared chiefly upon the basis of sugar content, were tested as attractants. Weekly collections of *C. molesta* from 30 different baits are summarised. The proportion of sugar in the solution, which can be increased by using higher grades of syrup, has been shown to be more important than dilution within reasonable limits. Collective results of the past three years show that collections from sodium arsenite and molasses baits approximate to those from fermenting molasses baits, the former being superior during hot weather when molasses baits ferment very rapidly. A list is given of other economic insects attracted to baits, none of which, however, was caught in sufficient numbers to reduce the population except possibly fruit-flies (*Rhagoletis cingulata*, Lw.) and Noctuids. Baited plots did not show a reduction of injury from *C. molesta* as compared with control plots, but the moths were attracted into them by the baits. Bait pails as hitherto observed in these studies do not constitute a satisfactory method of reducing the numbers of *C. molesta*.

PETERSON (A.). **Some Factors that limit artificial control Efforts for the Oriental Peach Moth** *Laspeyresia molesta* **Busck.**—*J. Econ. Ent.*, xxii, no. 1, pp. 108–115. Geneva, N.Y., February 1929.

The following is taken from the author's abstract:—The author summarises the more important factors influencing and limiting the different control measures hitherto employed against *Cydia* (*Laspeyresia*) *molesta*, Busck, none of which has yet proved satisfactory or practical. He further expresses his opinion on the future possibilities of finding an insecticidal control measure based on ten years' experience with the moth. Ovicides, larvicides, dormant control measures, light traps, attractants and repellents are discussed.

LIPP (J. W.). **Preliminary Tests with possible Repellents of the Oriental Peach Moth.**—*J. Econ. Ent.*, xxii, no. 1, pp. 116–126, 1 pl., 1 fig., 7 refs. Geneva, N.Y., February 1929.

An account is given of a series of experiments carried out in New Jersey in 1927 for testing the repellent qualities of a number of chemicals in relation to the oriental peach moth [*Cydia molesta*, Busck]. The best of several methods employed appeared to be recording the number of eggs deposited on sprayed twigs in cages in the insectary and recording the number of moths coming to the bait pails, with and without evaporation cups containing the chemicals, in the orchard. In the insectary tests, sprays of crude alpha naphthylamine and Dippel's oil (a distillation product of animal bones from which the fat has been removed by boiling

water) gave the most satisfactory results. The orchard tests revealed four chemicals, furfural, Dippel's oil, ammonium sulphide and amyl acetate, which showed at least 50 per cent. repellent qualities. An apparatus for use in field studies with repellents is also described.

Hartzell (F. Z.). **Relation of Snow Cover to Infestation by the Grape Berry Moth** (*Polychrosis viteana* **Clemens**).—*J. Econ. Ent.*, xxii, no. 1, pp. 126–132. Geneva, N.Y., February 1929.

The various theories hitherto propounded to explain the occasional occurrence of general infestations of *Polychrosis viteana*, Clem., in the grape belt along the south shore of Lake Erie are reviewed, and the hibernating habits of this moth and the factors affecting its survival are discussed. As the result of investigations carried out in western New York over a number of years by the aid of topographical surveys affording a comparison of snow cover and the distribution of the moth, the survival of *P. viteana* during a normal winter was found to be rather closely related to the amount of snow cover present during periods when the temperature dropped to near 0° F. Unless some form of cover is present, most of the pupae, to which temperatures of 10° F. and under appear to be fatal, perish if the hibernating cocoons are exposed to the rigours of winter. Snow drifting in vineyards on level or north sloping ground furnishes the most continuous cover for the cocoons, and such areas constitute foci of infestation for the moth except during abnormal winters. Practical immunity is secured either by removing obstructions that cause drifts or by avoiding the planting of vines in such places.

Dozier (H. L.) & Butler (H. G.). **Life-history and Control of the Grape Berry Moth in Delaware.**—*J. Econ. Ent.*, xxii, no. 1, pp. 132–136. Geneva, N.Y., February 1929. Also in *Trans. Peninsula Hort. Soc.*, 1929, pp. 118–124, 5 figs. Dover, Del., 1929.

Although *Polychrosis viteana*, Clem., has been present in Delaware for the past 16 years and is now believed to be distributed throughout the State, no noticeable loss was caused until 1926, and injury was reported from comparatively few vineyards. This moth, however, now appears to be spreading rapidly and causing more serious loss each year. Studies during 1928 showed that an almost complete third brood developed at Camden, and a partial third brood at Newark, 45 miles further north.

At Camden the larvae began to hatch and enter the berries about 25th June, though the first moths had emerged on 28th May in the insectary. The mature larvae left the berries from 1st to 31st July and usually at once enclosed themselves in folded leaves for pupation. The average length of the pupal stage in the insectary was 11 days, and the moths emerged from 12th July till 12th August. The maximum duration of the active laying period was 11 days. Hatching of the second brood of eggs lasted from 21st July till 22nd August, the average incubation period being 3·96 days. Most of the eggs are laid on the young berries, and only in a few instances have eggs been found on the stems. The average length of the feeding stage of the second brood larvae was 20·3 days, and they left the fruit from 8th August till 20th September, though none of those leaving after 3rd September

transformed. The average pupal period of this brood was 12·88 days, the adults emerging from 20th August until 22nd September. The pre-oviposition period averaged 4·7 days, and the time between emergence and last oviposition averaged 9·5 days. The eggs of the third brood were laid from 26th August till 6th October. The average incubation period of these eggs, about 50 per cent. of which hatched, was 7 days, they began to hatch on 29th August, and the average length of the feeding period of the larvae was 26 days, with a maximum of 45. Larvae in the insectary matured and left the fruit as late as 10th November. In an additional series of studies carried out at Newark development occurred somewhat later, and in experiments none of the eggs laid by the second generation of moths hatched.

Four species of parasites, the Braconids, *Bassus annulipes*, Cress., and *Microbracon* sp., and the Ichneumonids, *Glypta mutica*, Cush., and *Angitia* (*Dioctes*) *obliterata*, Cress., were reared during July from *P. viteana*. Control measures recommended include the removal of leaf accumulations under hedgerows and grassy strips between vineyards and the use of a good adhesive and spreader for sprays. Choice, light-pressed Menhaden fish-oil used at the rate of 1 qt. to 200 gals. gave the most satisfactory results, but should not be used after 20th June, owing to the danger of spray residue. A pre-blossom spray containing lead arsenate is essential, and the second and third sprays should be directed on to the grape clusters.

Phipps (C. R.). *Syneda alleni* **Grt., a Cutworm destructive to Blueberry in Maine.**— *J. Econ. Ent.*, xxii, no. 1, pp. 137–140. Geneva, N.Y., February 1929.

Blueberries in Maine are often attacked in early spring by various climbing cutworms, and in some seasons they cause severe losses to the crop by destroying the swelling buds [*cf. R.A.E.*, A, xvi, 88]. Foliage, green and ripe berries and even bark were attacked in a severe outbreak of *Syneda alleni*, Grote, which occurred in 1927 and reached its height at midsummer. The moths were very numerous in the blueberry fields in the following June. This Noctuid, all stages of which are briefly described, has not apparently been previously recorded as a pest. The larvae differ from ordinary cutworms and resemble Geometrids in their slender appearance, looping movement, diurnal habit and extreme activity. Moths were taken in the field on 21st June and began oviposition in captivity on 28th June. The first larvae were observed on 4th July, and all the eggs had hatched by 10th July, after which date many larvae were found in the field. The total period of larval development from hatching to pupation was 8–9 weeks. Spraying with 1–1½ lb. lead arsenate in 50 U.S. gals. water gave good control, and a fermenting bait composed of 1 part syrup to 12 parts water, with yeast and a little honey, gave an average total catch of about 200 moths to the pan.

Dozier (H. L.). **Further Results with Fish Oil as an Adhesive.**— *J. Econ. Ent.*, xxii, no. 1, pp. 140–146, 2 pls., 1 ref. Geneva, N.Y., February 1929. Also in *Trans. Peninsula Hort. Soc.*, 1929, pp. 75–79, 2 pls., 1 ref. Dover, Del., 1929.

Orchard experiments in the use of Menhaden fish-oil as an adhesive for lead arsenate in various spray combinations, begun in Delaware

in 1927 [*R.A.E.*, A, xvi, 394], were extended during 1928 with excellent results. The grade of fish-oil used (less than 5 per cent. of free fatty acid specified) proved apparently compatible with the sprays employed, which included Bordeaux mixture, commercial liquid and dry lime-sulphur, dry-mix sulphur-lime, and lead arsenate combined with lime alone, since no scorching occurred. The darker, cheaper grades of fish-oil with high free fatty acid content do not give good results. From 1 to 1½ qts. fish-oil was used to the 200 gal. tank. Indiscriminate use of this material late in the season is liable to complicate the spray residue problem, but the results of the past season indicate that it can be applied with safety up to 25th June under normal conditions. After that date the use of casein-lime spreader or supplemental dusting is recommended. Of the various types of spraying equipment employed, the best results were secured with one that produces a fine mist coverage, but this cannot be used with safety so late as the ordinary power outfit, which gives less effective cover.

The use of 1 U.S. qt. fish-oil to 6 lb. lead arsenate, 25 lb. lime and 200 U.S. gals. water in the calyx and three cover sprays, applied as a fine mist coverage to a plot of apples and the last application made on 20th July, resulted in considerable reduction in fruit infested by the codling moth [*Cydia pomonella*, L.]. The residue, although sticking throughout the heaviest rains, was easily washed off. Good results were secured with the oil in lead arsenate sprays applied to grapes in pre- and after-blossom sprays against *Polychrosis viteana*, Clem., but it should not be used later than 20th June, sufficient protection being afforded before that date to control any ordinary infestation. Where later applications are necessary, casein-lime spreader or fish-oil soap can be used with greater safety. Fish-oil was also used in mixed sprays on peaches at the rate of 1 pt. to 100 gals. in the "shuck fall" spray with excellent results.

Poos (F. W.). **Leafhopper Injury to Legumes.**—*J. Econ. Ent.*, xxii, no. 1, pp. 146–153, 2 pls., 1 fig., 6 refs. Geneva, N.Y., February 1929.

The following is taken from the author's abstract: A brief report is given on preliminary studies carried out in 1928 on leafhopper injury to various leguminous plants. Among 14 Jassids and one Membracid tested in cages, only *Empoasca fabae*, Harr., caused the injury, which was serious on lucerne, red clover, white clover, non-pubescent soy beans, peanuts and sainfoin. The disease-like symptoms are probably due to the injection of some chemical or enzymic toxin; no example of *E. fabae* free from the infectious principle has been found. Plants not too badly injured always recovered when the insects were removed.

Carter (W.). **The Purpose of predicting Outbreaks of *Eutettix tenellus* (Baker) under Present-day Conditions.**—*J. Econ. Ent.*, xxii, no. 1, pp. 154–158, 1 ref. Geneva, N.Y., February 1929.

Districts coming under consideration as possible subjects for the prediction of outbreaks of *Eutettix tenella*, Baker, in Utah and Idaho are divided into three types. The importance of this work for districts situated in proximity to breeding grounds has been proved, and the

results already secured towards obtaining beets resistant to curly-top have encouraged the beet industries so situated to maintain their position there. Of the types of district that become infested as the result of migration from a distance, prediction is desirable only in respect of those that suffer severely and regularly. Location of centres of dispersal, followed by detailed studies of these centres and of the probabilities of the insect reaching the beet fields are essential in such cases. Prediction of outbreaks is not recommended for districts of the third type where curly-top is not the limiting factor, and where only occasional damage results from migration, the reason for which is obscure and difficult to determine.

CARTER (W.) & CRAWFORD (R. F.). *Eutettix tenellus* (**Baker**) **as a Factor in the Production of Nicotine for insecticidal Purposes.**— *J. Econ. Ent.*, xxii, no. 1, pp. 158–160. Geneva, N.Y., February 1929.

In the summer of 1927 a diseased condition was observed in experimental plantings of tobacco (*Nicotiana rustica*) grown as a source of nicotine in New Mexico. The disease appeared about 20th June, and although it did not seem to spread to any extent after that date, many of the affected plants died early in the season or remained stunted or dwarfed. Inoculation of healthy plants with juice extracted from diseased plants gave negative results. Although none of the insects taken from the plants was identified as *Eutettix tenella*, Baker, healthy beets developed typical symptoms of curly-top when non-infective leafhoppers of this species were transferred to them after being caged on the diseased tobacco plants in the laboratory. These experiments definitely established the disease as curly-top. The absence of *E. tenella* from the field at the time of the collections is accounted for by the inability of this leafhopper to live long on many plants susceptible to the virus transmitted by it. It was observed that a native tobacco, which proved as suitable for commercial purposes as the crop at present grown, was immune from the disease. The absence of the disease in one field of *N. rustica* when affected fields were visited in September is attributed to the date of planting.

WOODRUFF (L. C.). *Eupelmus popa* **Girault, a Parasite of the Sorghum Midge,** *Contarinia sorghicola* **Coquillett.**— *J. Econ. Ent.*, xxii, no. 1, pp. 160–167, 8 refs. Geneva, N.Y., February 1929.

The Encyrtid, *Eupelmus popa*, Gir., was already well established when first discovered in the United States in 1920 [*R.A.E.*, A, x, 422] and has now become the most effective parasite of *Contarinia sorghicola*, Coq. (sorghum midge). The parasite was probably introduced in shipments of *Sorghum* seed from Asia, where it is known to be present. It is widely distributed throughout Texas and has also been observed in Missouri and Virginia. The eggs are laid singly on the inner glumes of a spikelet of *Sorghum* infested by *C. sorghicola*. Of 26 eggs under observation, 24 hatched in approximately 18 hours. Upon hatching, the young larva immediately seeks a midge larva, tears a hole in the body of the host and feeds till the contents of the latter are exhausted. The pupae are readily attacked by the older parasitic larvae, but

hibernating larvae rarely suffer. The parasites, the feeding habits of which are not uniform, may complete their development on one host or may require as many as three, and a few feed on the plant itself after having consumed one host, even when others are present. All attempts to induce development on plant sap alone, however, have failed. It is therefore assumed that *E. popa* is in a less advanced stage of transition to phytophagy than certain Eurytomids having similar habits already noticed [*R.A.E.*, A, x, 238 ; xv, 626]. In the course of external feeding on the larva of *C. sorghicola*, *E. popa* probably consumes the internal Eulophid parasites of the host, *Aprostocetus diplosidis*, Crwf., and *Tetrastichus* sp.

Development from egg to adult under normal summer temperatures occupies 14–18 days, the larvae requiring 6–12 days to complete their growth and the pupal stage lasting about 6 days. Oviposition, the method of which is described, begins about 6 days after the eggs of *C. sorghicola* have been laid in the grain head. The average adult life under cage conditions was 6 days for females and 3 days for males. Emergence begins in the spring, and successive generations occur until development is stopped by frosts in autumn, ten having been reared in field cages during one season. The parasite is slow to gain control of the host and does not materially affect the amount of damage done until late in the summer. A few of the larvae of each generation hibernate within the spikelets and pupate and emerge at about the same time the following spring. There are some indications that *E. popa*, the behaviour of which shows remarkable adaptation to that of its host, may, like the latter, delay its emergence in some cases until the second spring.

Caffrey (D. J.). **A general Summary of the European Corn Borer Situation in the United States at the Close of 1928.**— *J. Econ. Ent.*, xxii, no. 1, pp. 167–171. Geneva, N.Y., February 1929.

During 1928, the territory in the Great Lakes section known to be infested by *Pyrausta nubilalis*, Hb., was extended to include a strip from 10 to 30 miles in width contiguous with the limits previously established. The results of the 1928 survey in this section indicated either that a decided reduction in corn borer abundance had occurred in all districts where a satisfactory disposal of maize residues, etc., of 1927 had been effected, or that the normal rate of increase was greatly reduced. The absence of compulsory disposal of residues or the inability to secure proper enforcement resulted in corresponding pronounced increases in borer abundance. A survey of the central part of the original district of infestation in eastern New York showed an increase of 13·9 per cent. in borer population as compared with 1927, and commercial losses estimated as ranging from 5 to 25 per cent. were occasioned in a few fields of early sweet maize. A general survey of the whole of this district, made for the first time in 1928, showed 9·02 per cent. of the maize plants infested and an average of 14·6 borers to 100 plants. A decided increase in density of infestation has occurred during 1928 in the southern portion of the two-generation district in New England, where the absence of clean-up laws in Rhode Island has resulted in a rapid increase in borer population, which has spread to the adjacent area of Massachusetts. In addition to severe infestation of field and sweet

maize, potato, beet, lima beans [*Phaseolus lunatus*], pepper and dahlias were attacked, as well as susceptible weeds. Limited infestations also occurred on celery, green beans, sunflower, aster and gladiolus.

A total of 1,000,000 additional imported parasites were liberated in the field during 1928. Seven species have been recovered under such circumstances and in such numbers as to indicate their permanent establishment.

Houser (J. S.) & Huber (L. L.). **Nutrition as a Factor in the Responses of the European Corn Borer.**—*J. Econ. Ent.*, xxii, no. 1, pp. 171–174. Geneva, N.Y., February 1929.

The following is taken mainly from the authors' abstract: Statistical studies of data secured in Ohio and elsewhere indicate that the abundance of *Pyrausta nubilalis*, Hb., is largely determined by the growth condition of the food-plant, which affects its attractiveness to the ovipositing moths and also the rate of establishment and survival of the larvae. The various responses of the borer, such as the rate of spread, the rate of accumulation, the seasonal fluctuation in population and the ultimate saturation point are influenced by the physico-chemical processes of maize.

Patch (L. H.). **Some Factors determining Corn Borer Damage.**—*J. Econ. Ent.*, xxii, no. 1, pp. 174–183, 5 refs. Geneva, N.Y., February 1929.

The following is taken from the author's abstract and summary: Observations and experiments conducted on *Pyrausta nubilalis*, Hb., in Ohio in 1927 and 1928 indicate that the greater corn borer populations in the earliest plantings of both field and sweet maize are due to the preference of the moth for the tallest plants. Height predominates as the factor attracting moths to oviposit, early maturity being of importance when maize of the average height or taller is near or in the silking stage and other plantings of maize are not. One year's results indicated that the moths show a preference for maize of very early maturity and of about average height or taller. Next in preference is the variety of maize that is tallest throughout the oviposition period of the moth, although such a variety is late in maturing. Short varieties, although early in maturing, and varieties that mature late and are relatively short during the early part of the oviposition period receive the fewest egg-clusters.

The percentage of survival of larvae was not found to be dependent on the maturity of the maize, nor on its planting date or date of tasselling or silking. Borers hatching on maize planted on 1st June have as good a chance of reaching maturity as those hatching on maize planted earlier. Greater corn borer populations in sweet and flint maize, as compared with the larger field maize dent types, are probably partly due to the fact that a greater percentage of borers reaches maturity in the former. The survival on one variety of sweet maize in 1928 was 77 per cent. greater than that on two varieties of the large dent maize, although the moths showed no preference for ovipositing on sweet varieties. For all varieties of maize the percentage of survival in 1927 and 1928 has averaged 34·8 per cent., or more than double the 15 per cent. survival formerly obtained with artificial infestation.

Parker (H. L.), Thompson (W. R.), de Rippas (P.) & Kozlovsky (S.). **A Study of the Abundance of** *Pyrausta nubilalis* **Hübn. in Corn (***Zea mays* **L.) in Southwestern France.**— *J. Econ. Ent.*, xxii, no. 1, pp. 183–195, 7 charts, 11 refs. Geneva, N.Y., February 1929.

The following is taken chiefly from the authors' summary: An extensive study of the degree of infestation in maize by *Pyrausta nubilalis*, Hb., based on the theory of E. N. Transeau that the type of vegetation is the simplest index to the numerous and complicated factors governing insect abundance [*R.A.E.*, A, xv, 439, 536], has been made in ten phytogeographic zones in south-western France. The degree of infestation ranges from 1·2 per cent. in the zone of the Ericaceae under the influence of the Atlantic climate to 26·91 per cent. in the zone characterised by a calcareous soil and a pronounced penetration of Mediterranean flora. The authors are of the opinion that the various zones in south-western France, with the possible exception of the low, sandy, pine-covered region known as the Landes section, where the climate probably accounts for the constant low degree of infestation, do not differ enough in degree of infestation to permit these variations being ascribed to different primary climatic influences as expressed by the dominant plant groups. No definite relation exists between the degree of infestation and altitude up to 800 metres [2,600 ft.], nor apparently between the depth of water and degree of infestation. Approximate analyses indicated that clay soils are slightly more infested than sandy soils. Studies of infestation in relation to variety of maize showed differences varying between 10 and 25 per cent.

Herrick (G. W.). **Two Scale Insects, their Bionomics and Control.**— *J. Econ. Ent.*, xxii, no. 1, pp. 198–202. Geneva, N.Y., February 1929.

Observations of *Chionaspis pinifoliae*, Fitch (pine-leaf scale), which infests various pines and spruce in parks and gardens, and *Neolecanium cornuparvum*, Thro (magnolia soft scale), carried out over a number of years, indicate that both these Coccids are susceptible to the effects of certain insecticides, notably oils. *C. pinifoliae*, which is widely distributed throughout the United States, appears to have normally only one generation a year in New York State, though it is thought that a partial second may occur under favourable conditions. During two seasons' observations, the eggs hatched during late May and early June, but few individuals matured before the end of August, and there has been no evidence to show that the eggs laid by these mature before the following spring. There is a considerable interval of time during late June and early July when the young forms are unprotected by a waxy scale and are therefore vulnerable to a covering spray. Experiments indicated that they can be controlled by sprays containing oil emulsion combined with nicotine sulphate.

N. cornuparvum, which has been frequently confused with *Lecanium magnoliarum*, Ckll., and discussed by some authors under that name, occurs on various species of magnolia and has been reported from 15 States east of the Mississippi River. The Coccids hibernate in the second instar and may be present in large numbers on the undersides of the branches of an infested tree. They mature early in August and produce young that are in a vulnerable condition from October until

the middle of April. These is only one generation a year. An application of an emulsion composed of 1 part Volck oil to 32 parts water made on 18th April 1928 and followed by 48 hours with the temperature above freezing point almost exterminated the scale.

HARTZELL (F. Z.). **Application of one of Pearson's Probability Theorems and some special Probability Equations to Entomological Data.**— *J. Econ. Ent.*, xxii, no. 1, pp. 202–209, 12 refs. Geneva, N.Y., February 1929.

The following is the author's abstract : Entomological data that are dichotomously divisible can be analysed by probability methods which seem preferable, in some cases at least, to the usual procedure. K. Pearson has furnished a system that is well adapted to such an analysis. The method of determining the probable error of a percentage is included for use with certain data.

OSBORN (H.). **Leaf-hopper Immigrants of Economic Interest.**— *J. Econ. Ent.*, xxii, no. 1, pp. 209–213. Geneva, N.Y., February 1929.

It is concluded that many of the leafhoppers of the United States, which owing to their small size and inconspicuous character have hitherto escaped adequate consideration, are immigrants from tropical regions, since they are restricted to introduced plants and have no seasonal cycles. The egg stage is favourable to the introduction of such species, particularly from Europe or northern Asia. Introduction in the nymphal and adult stages appears to be dependent upon rapid transit and connection with a food-supply, combined with opportunity to transfer to living plants on arrival. Hibernating adults might be introduced with objects in which they were secreted. Notes are given on the distribution and in some cases the possible method of introduction of the following : *Idiocerus scurra*, Germ., *I. cognatus*, Fieb., *Allygus mixtus*, F., *Platymetopius hyalinus*, Osb., *Deltocephalus pulicarius*, Fall., *D. pascuellus*, Fall., *D. ocellaris*, Fall., *D. collinus*, Boh., *D. flavicosta*, Stål (the species of this genus, though widely distributed, have probably not been spread artificially), *Euscelis obscurinervis*, Stål, *Draeculacephala reticulata*, Sign., *Cicadula sexnotata*, Fall., *Balclutha punctata*, Thunb., *Empoasca fabae*, Harr., *Eupteryx melissae*, Curt., *Typhlocyba ulmi*, L., *T. rosae*, L., and *Peregrinus maidis*, Ashm. *Perkinsiella saccharicida*, Kirk., has not yet been found in the United States, and every precaution should be taken to prevent its introduction.

KNIGHT (P.). **What shall we teach Students in beginning Entomology?** *J. Econ. Ent.*, xxii, no. 1, pp. 213–217. Geneva, N.Y., February 1929.

The following is taken from the author's abstract : The selection of the aims or objectives of the elementary course are discussed in the light of the opinions of numerous teachers throughout the United States and Canada. The question whether the approach to the first course shall be economic or fundamental is more particularly discussed. A tabular analysis of twelve elementary courses at different institutions furnished by the instructors in charge is presented at the end of the paper.

Siegler (E. H.) & Brown (L.). **A Digest of additional Experiments in the Application of Paradichlorobenzene in Solution against the Peach Borer.**—*J. Econ. Ent.*, xxii, no. 1, pp. 217–221, 1 ref. Geneva, N.Y., February 1929.

Additional experiments in the control of *Aegeria exitiosa*, Say (peach borer) with paradichlorobenzene dissolved in petrol, applied around the bases of the peach trees, were conducted in Maryland in the spring and autumn of 1927 [*cf. R.A.E.*, A, xvi, 122]. The results appear to indicate that the solution, even without preparation of the soil before treatment and without banking with soil following the application, is as effective as the crystals applied in the usual way. The use of varying proportions of the solvent in excess of 50 cc. to 1 oz. paradichlorobenzene apparently decreases the efficiency of the treatment.

Brinley (F. J.). **Toxicity of Lead Salts to Insects.**—*J. Econ. Ent.*, xxii, no. 1, pp. 221–225, 1 ref. Geneva, N.Y., February 1929.

Tests carried out to determine the toxicity of certain lead salts to *Malacosoma americana*, F. (tent caterpillar), which feeds rapidly and consumes large amounts of foliage, indicated that lead chromate, lead sulphate, lead carbonate and lead oxide are slowly toxic to the larvae in the order given. The average area of treated foliage consumed by one larva and the period between first feeding and death were 16·99 sq. cm. and 8·7 days with lead oxide ; 15·83 and 7·7 with lead carbonate ; 8·9 and 8·7 with lead sulphate ; and 1·77 and 7·7 with lead chromate. With untreated foliage 27·73 sq. cm. was eaten in 8·1 days. There appears to be a direct relationship between toxicity and molecular weight, an increase in molecular weight increasing toxicity. The amount of lead in the body of the larva at the time of death, exclusive of the digestive tract, per milligram of bodyweight, remains constant regardless of the amount of lead oxide eaten.

Davidson (W. M.). **Insecticidal Tests with Oils and Alkaloids of Larkspur** (*Delphinium consolida*) **and Stavesacre** (*Delphinium staphisagria*).—*J. Econ. Ent.*, xxii, no. 1, pp. 226–234, 1 ref. Geneva, N.Y., February 1929.

Tests with oils and alkaloids of *Delphinium consolida* and *D. staphisagria* demonstrated that the seeds of these plants have insecticidal properties [*cf. R.A.E.*, A, xiii, 239]. Soap emulsions containing 2 per cent. of the oil gave satisfactory control of *Tetranychus telarius*, L., and *Paratetranychus pilosus*, C. & F., and even a 1 per cent. concentration had considerable effect both in greenhouse and field tests. Although a 2 per cent. concentration was effective against *Aphis rumicis*, L., *A. pomi*, DeG., *Myzus persicae*, Sulz., *M. cerasi*, F., and *Macrosiphum rosae*, L., it proved of little value against *Thrips tabaci*, L., *Leptinotarsa* (*Doryphora*) *decemlineata*, Say, *Pieris* (*Pontia*) *rapae*, L., and *Evergestis rimosalis*, Guen. Young larvae of *Trialeurodes* (*Aleurodes*) *vaporariorum*, Westw., were killed, but other stages proved resistant, and only a moderate degree of control was secured by the use of a 3 per cent. emulsion, which caused severe injury to foliage. Fair results were obtained with a 2 per cent. emulsion against *Chrysomphalus* sp. and *Aspidiotus perniciosus*, Comst.

Two crystalline alkaloids (delcosine and delsoline [xiii, 240]) isolated from the seeds of *D. consolida* were highly toxic to Aphids and thrips,

ineffective against mites, and of value as stomach poisons against certain of the leaf feeders, such as *Hyphantria cunea*, Dru., and *Pieris rapae*, at a solution of 0·085 per cent. An alkaloid, delphinine hydrochloride, isolated from *D. staphisagria*, at concentrations up to 0·16 per cent., proved much less toxic, though a 0·085 per cent. solution killed 89 per cent. of the larvae of *T. tabaci* and was effective as a stomach poison against larvae of *P. rapae*. The value of these products as insecticides was found to be diminished owing to the fact that the margin of safety on plant tissues was small. In the case of the mites, at least, this margin is apparently sufficient.

STREETER (L. R.). **Bentonite as a Dust Carrier for Nicotine.**— *J. Econ. Ent.*, xxii, no. 1, pp. 234–235, 3 refs. Geneva, N.Y., February 1929.

The experiments described show that the suggestion that heavy losses of nicotine reported in connection with the employment of bentonite as a dust carrier were due to rapid decomposition of the nicotine is incorrect. Bentonite has high adsorbing powers and should not be used as a carrier for nicotine where volatility is desired. Rapid decomposition of the nicotine from mixtures of bentonite and nicotine sulphate does not take place. Nicotine can be recovered from bentonite quantitatively by steam distillation.

COLE (F. R.). **Fumigation with Calcium Cyanide for the Control of the Greater and Lesser Bulb Flies.**— *J. Econ. Ent.*, xxii, no. 1, pp. 236–237 Geneva, N.Y., February 1929.

Satisfactory results have been secured in experiments with calcium cyanide in the form of finely ground powder for the control of *Merodon* [*equestris*, F.] (greater bulb-fly) and *Eumerus* (lesser bulb-fly). About 10,000 bulbs can be fumigated in an airtight box of 100 cubic feet capacity, for which a dosage of 12 oz. and an exposure of 4 hours is recommended. The temperature should range between 60 and 90° F., and no additional moisture is required unless humidity is very low. None of the larvae present in treated bulbs survived, and subsequent experiments have shown that low temperatures are the only obstacle to obtaining 100 per cent. mortality in all stages.

CARTER (W.) & COTNER (F. B.). **Isolation of certain Yeast Forms from *Eutettix tenellus* Baker.**— *J. Econ. Ent.*, xxii, no. 1, pp. 237–241, 1 pl., 7 refs. Geneva, N.Y., February 1929.

The importance of the internal condition of the insects in connection with insect-borne diseases of plants is emphasised, and attention is called to two yeast forms found in culture solutions after the feeding of *Eutettix tenella*, Baker. One of these is a new species described by Cotner as *Torula tenellicola* and the other is *Monilia nigra*. No isolation of the organisms could be made from beets on which no leafhoppers had fed, but both were recovered from beets that had been attacked by them. Both organisms have also been obtained from infective and non-infective leafhoppers. The effect of these two yeasts on the optical rotation of sugars is shown in a table.

Smith (M. R.). **Two introduced Ants not previously known to occur in the United States.**—*J. Econ. Ent.*, xxii, no. 1, pp. 241–243. Geneva, N.Y., February 1929.

Two species of imported ants, *Iridomyrmex iniquus*, Mayr, and *Wasmannia auropunctata*, Roger, are recorded for the first time in the United States, though already established there. *I. iniquus*, which was probably introduced with orchids from Brazil, was found in a greenhouse in Illinois, in which it is said to have been present since 1914. It does not appear to develop rapidly enough under hothouse conditions to be considered a serious pest. It was particularly noted to attend *Coccus hesperidum*, L., and *Pseudococcus citri*, Risso, on *Citrus*, and *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) on palms. The nests were found in the soil of pots or of the floor of the greenhouse. A key is given for the determination of the workers of *I. iniquus* and the imported Argentine ant, *I. humilis*, Mayr, and of *I. pruinosus*, Roger, and *I. pruinosus* var. *analis*, André, which are native to the United States. The characters distinguishing the genus *Wasmannia* from *Tetramorium*, in which genus *W. auropunctata* has sometimes been placed, are pointed out. This ant was taken in a single locality in Florida.

Jones (R. M.). **Leafhoppers (Homoptera, Cicadellidae) found on the Sugar Beet in Iowa.**—*J. Econ. Ent.*, xxii, no. 1, pp. 243–245, 4 refs. Geneva, N.Y., February 1929.

A list is given of the leafhoppers found during a survey of the insect pests feeding on sugar-beet, carried out in Iowa in August 1928, in the course of which no trace was found of either *Eutettix tenella*, Baker, or of curly-top. A review of the literature indicates that only 9 other species of leafhopper have hitherto been recorded on sugar-beet in the United States. All these were found in Iowa, as well as four additional species, *viz.*, *Cicadula variata*, Fall., and *Platymetopius cinereus*, Osb. & Ball, which were common in all fields, *Euscelis obscurinervis*, Stål, which was fairly common, and *Xestocephalus superbus*, Prov., of which only a few specimens were taken.

Flanders (S. E.). **The Production and Distribution of *Trichogramma*.**—*J. Econ. Ent.*, xxii, no. 1, pp. 245–248. Geneva, N.Y., February 1929.

A brief account is given of the method and equipment employed by the author in California for breeding *Trichogramma* [*minutum*, Riley] on the eggs of *Sitotroga cerealella*, Ol., and of the procedure followed in liberating it. By this method, a daily production of a million parasites is obtained.

Van Dine (D. L.). **Parasites of Sugar Cane Moth Borers.**—*J. Econ. Ent.*, xxii, no. 1, pp. 248–268, 73 refs. Geneva, N.Y., February 1929.

This report constitutes a review of the parasites of *Diatraea saccharalis*, F. (sugar-cane moth stalk-borer) and other moth borers in Cuba, and of the available records of those found in other countries. Lists are given in which the parasites are arranged according to country and

species. Some account is given of the work hitherto accomplished in connection with the breeding and introduction of parasites for the control of *D. saccharalis* in sugar-growing countries throughout the world, and the importance of a certain degree of international co-operation in surveying areas for the occurrence of parasites is pointed out. Before proceeding to surveys and introduction work, investigations are being carried out in Cuba, where parasites exercise important natural control of *D. saccharalis*, to secure further information concerning their identity, distribution and seasonal occurrence, the factors influencing their abundance or limiting their activity, and their comparative efficiency.

CHANDLER (S. C.). **Persimmon as a Host of the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxii, no. 1, p. 268. Geneva, N.Y., February 1929.

The fact that persimmon can act as an alternative food-plant for the later broods of *Cydia* (*Laspeyresia*) *molesta*, Busck, was demonstrated in Illinois in October 1928, when two larvae about one-third grown, when placed on wild persimmon, entered and riddled the fruit and left it two weeks later to spin their cocoons.

LIPP (J. W.). **The Purity of Commercial Orthodichlorobenzene.**—*J. Econ. Ent.*, xxii, no. 1, p. 268. Geneva, N.Y., February 1929.

Quotations from a letter received from a manufacturer of insecticides indicate that no technically pure orthodichlorobenzene is offered on the market, the material commonly sold under that name containing about 30 per cent. para-, 40 per cent. ortho-, and 30 per cent. tri-chlorobenzene.

WOLCOTT (G. N.). *Marasmia trapezalis* **Guenée on Sugar-cane only in Hispaniola and Peru of the Western Hemisphere.**—*J. Econ. Ent.*, xxii, no. 1, pp. 268-269. Geneva, N.Y., February 1929.

Though *Marasmia trapezalis*, Guen., is absent from Cuba, Jamaica and Porto Rico, as was pointed out when this Pyralid was first reported on sugar-cane in Haiti and Santo Domingo [*R.A.E.*, A, xiii, 342], its presence on the same food-plant in Peru, which was recently recorded by C. H. T. Townsend in a paper already noticed [xvii, 100], is confirmed from personal observation by the author, who states that the distribution includes practically all the localities where cane is grown, not only along the coast, but also in the trans-Andean region. Injury to sugar-cane by the larvae of *M. trapezalis* in many parts of Peru is so obvious that the determination of its distribution in other parts of South America is of interest. It has not been observed by the author in Venezuela or by H. E. Box in British Guiana, Venezuela or Argentina.

YOTHERS (M. A.), WEBSTER (R. L.) & SPULER (A.). *Heleria rubidella* **Ball. Comparatively unknown Membracid becomes abundant and probably injurious in Orchards in the Wenatchee, Wash., District,** —*J. Econ. Ent.*, xxii, no. 1, p. 269, 1 ref. Geneva, N.Y., February 1929.

Heleria rubidella, Ball, which was first noticed during spraying operations in an orchard in the Wenatchee Valley, Washington, in

1926, was observed there in great numbers in 1928 on the twigs and smaller branches of apple in orchards bearing lucerne as a cover crop. The fact that this was the first recorded occurrence of this species west of Colorado, where it was described in 1918, was learned too late to admit of making observations and collections.

THOMPSON (B. G.). **Note on the Occurrence of the Dusky-veined Walnut Aphis, *Callipterus juglandis*, Frisch (a European Insect) in America.**—*J. Econ. Ent.*, xxii, no. 1, p. 270. Geneva, N.Y., February 1929. Also in *Pan-Pacific Ent.*, v, no. 3, p. 122. San Francisco, Cal., January 1929.

Callipterus juglandis, Goeze (dusky-veined walnut aphis), not previously recorded as occurring in the United States, was found in the summer of 1928 injuring walnuts in north-western Oregon, where about 3,000 acres of trees were affected. This Aphid is much larger than *Chromaphis juglandicola*, Kalt., from which it differs in working entirely on the upper surfaces of the leaves. As many as 50 Aphids were found on a leaf along the midrib, the infested leaves being blotched with yellow and the midribs blackened and shrivelled. Applications of a 2 per cent. nicotine dust, made after midnight and before 8 a.m. and begun on 20th July when apterous forms predominated, gave excellent control. Owing to windy conditions dusts applied during the day were ineffective.

MATHESON (R.). **Collecting Vial for small Insects.**—*J. Econ. Ent.*, xxii, no. 1, pp. 270–271. Geneva, N.Y., February 1929.

A vial of the type described by Crowell [*R.A.E.*, A, xvi, 678] having been found unsatisfactory, owing to the slipping of the wire screen cone, the author describes a simpler one consisting of glass tubing 1 in. in diameter and about 5 in. long, one end of which is inverted within the tube in the form of a cone. The other end of the tube is closed with a cork, which can be easily removed to take out captured insects.

COCKERELL (T. D. A.). *Cryptolaemus montrouzieri* **Mulsant, and its Allies.**—*J. Econ. Ent.*, xxii, no. 1, p. 271. Geneva, N.Y., February 1929.

The author discusses the country of origin of *Cryptolaemus montrouzieri*, Muls., which is said to have come from Queensland, but which might well have originated in New Caledonia, where its presence probably accounts for the comparative scarcity of *Ferrisia* (*Pseudococcus*) *virgata*, Ckll. He observed it in Noumea, New Caledonia, in 1928 on *Phaseolus* infested by *F. virgata* and Aphids. A partial key to the species of *Cryptolaemus* is given.

BOYCE (A. M.). **The Walnut Husk Fly. Life History and possible Control.**—*Diamond Walnut News*, xi, no. 1, pp. 15 & 19, 2 figs. Los Angeles, Cal., Cal. Walnut Gr. Assoc., February 1929.

BOYCE (A. M.). **A new Pest of English Walnuts in California.**—*J. Econ. Ent.*, xxii, no. 1, pp. 269–270. Geneva, N.Y., February 1929.

The first paper is the more detailed of two accounts of the Trypetid, *Rhagoletis juglandis*, Cress. (western walnut husk fly), which is a

potentially serious pest of certain commercial varieties of walnut in California [*R.A.E.*, A, xvii, 228]. Up to the present the fly has only been found on walnut, of which it apparently prefers the late, thick-husked varieties. Injury to the kernels was estimated at about 5–6 per cent. of the total infested nuts. The accounts of the life-history do not differ greatly from that already noticed [*loc. cit.*], but the egg stage is said to last 4–7 days, the larval stage 3–6 weeks and the pupal stage, in which the insect hibernates, 10 months. After the maximum emergence had taken place, the nuts were not so seriously injured, cases being frequently observed where eggs did not hatch and sometimes where young larvae did not mature.

Several species of scavenger flies have been reared from walnuts infested by *R. juglandis*, of which the most common are *Euxesta notata*, Wied., and *Lonchaea occidentalis*, Mall. They attack the husks of walnuts that are already decaying owing to mechanical or insect injury. The larvae of the two species resemble each other, and their habits are similar. They become abundant after the peak of emergence of *R. juglandis* is past and are present until the husks dry up entirely. The larval stage lasts 2–4 weeks, and pupation takes place in the soil.

Smith (R. H.). **Additional Information on controlling Codling Moth by Spraying and Dusting.**—*Diamond Walnut News*, xi, no. 1, pp. 8–9. Los Angeles, Cal., Cal. Walnut Gr. Assoc., February 1929.

In the Pacific North-west five sprays are necessary to control the codling moth [*Cydia pomonella*, L.] on apples, whereas on walnuts only a single spray is required. A partial explanation of this was obtained during 1927, when experiments showed that there was practically no loss of arsenic from either sprayed or dusted nuts, and since the poison was applied when the nuts were nearly full-grown, there could have been little thinning of the covering. On the other hand, apples showed a decided loss of arsenic due to weathering and they had, moreover, increased four or more times in surface area since the first spray was applied.

It was observed that between 24th May and about 1st July the newly hatched larvae showed a tendency to make their way to the point of contact of two nuts and remain, sometimes for two or three days, without showing any signs of having fed, though it seems likely that in such cases they feed superficially here and there on the surface. Even after making a burrow the larvae only feed slowly. Moreover, they were often observed outside their burrows, particularly in the early morning, either remaining near the entrance for hours or wandering $\frac{1}{4}$ in. or more from the opening.

In experiments to determine the manner in which they are killed, newly hatched larvae were allowed to crawl about on sections of glass sprayed or dusted with lead arsenate. They were then transferred to untreated apples, and it was found that a large number of them had become poisoned while moving over the glass. In view of the habits of the larvae on walnuts already described, it was expected that many of them would be killed by lead arsenate as well as by nicotine applied after they had hatched. Experiments were therefore carried out with a number of insecticides applied after the larvae had hatched, and it was found that $\frac{3}{4}$ U.S. pt. nicotine sulphate with 1 lb. caseinate spreader

in 100 U.S. gals. water was the most satisfactory, giving a mortality of 42·3 per cent. ; 4 lb. lead arsenate with 1½ lb. fish-oil soap chips in 100 U.S. gals. water was rather less effective, giving a mortality of 31·5 per cent.

In spraying against *C. pomonella* on apples the aim is to complete the first application just before the larvae begin to hatch, but in the case of walnuts the time of spraying should be gauged according to the size of the nuts as well as by the hatching of the larvae. Few eggs are laid on small nuts, and it seems advisable to ignore the earliest larvae to hatch, particularly as the above experiments have shown that an appreciable proportion of the larvae are killed by lead arsenate applied after they have hatched. There will often be uncertainty as to whether the loss caused by the larvae that escape will be more than offset by the increased protection the delayed spraying gives to the late nuts. In such cases the addition of nicotine is especially advisable.

Sundquist (R.). **Summer Oil Sprays and Codling Moth Control.**—*Better Fruit*, xxiii, no. 10, pp. 5–7. Portland, Ore., April 1929.

An account is given of experiments carried out in the Yakima Valley, Washington, in 1927 and 1928 to determine the value of summer oil sprays in the control of the codling moth [*Cydia pomonella*, L.] on apples. The sprays were timed with the help of moth traps, a cover spray being placed within 10 days of the first application and subsequent sprays being applied in some cases at regular intervals and in others by observations of the traps. The results indicated that oil alone, though an effective ovicide against the codling moth, cannot be depended upon to give satisfactory results in hot districts where the incubation period is short and the more volatile oils evaporate between sprays. A combination of 1 U.S. gal. oil emulsion (light grade highly refined summer oil), 2 lb. lead arsenate and ½ lb. spreader to 100 U.S. gals. water gave effective control of *C. pomonella* and also of Aphids and red spider [*Tetranychus*]. This combination kills the eggs of the codling moth and affords a heavier coating than lead arsenate used alone, without injuring the fruit or foliage or rendering more difficult the removal of residue.

Flint (W. P.). **Orchard Insect Control for 1928.**—*Trans. Illinois Hort. Soc. 1928*, lxii, pp. 97–109, 4 tables. Springfield, Ill., 1929.

Experiments on the control of the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apple in Western Illinois indicate that satisfactory results can be obtained by following the recommended spray schedule, it being highly important to apply a second spray 5–7 days after the calyx one.

Experiments were carried out with oil sprays for the control of second and third brood larvae of the codling moth [*Cydia pomonella*, L.]. Two sprays with a 2 per cent. white oil emulsion reduced the infestation to 1·1 per cent. and 0·7 per cent. respectively. The same oil at 1 per cent. with nicotine sulphate (1 : 800) gave an infestation of 0·3 per cent., and with derrisol (1 : 800) gave 1·1 per cent. A plot in the same orchard on which lead arsenate was used in the second brood sprays showed 5·2 per cent. infestation, as against 31 per cent. in an unsprayed plot. In another orchard in which sulphur and lead arsenate dust (80–20) was

applied against the second brood, lead arsenate sprays having been used against the first, only 5 per cent. of the fruit was infested at harvest. Further tests in banding [*cf. R.A.E.*, A, xvi, 566] showed crêpe paper and burlap-faced paper to be the best materials for attracting the larvae, corrugated paper being almost as satisfactory.

STEARNS (L. A.). **The Oriental Fruit Moth.**—*Trans. Illinois Hort. Soc. 1928*, lxii, pp. 111–122. Springfield, Ill., 1929.

This is a review of the bionomics and control of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) in the United States.

In recent years the author has been testing the value of hydrated lime as a physical or mechanical hindrance to the entry of the larvae into twigs and fruit, the lime being thickly applied either as a spray or a dust. Part of an orchard was sprayed 5 times with 40 per cent. nicotine sulphate (1 : 800) and hydrated lime (at rates varying from 60 to 100 lb. to 200 U.S. gals.) and once with the lime alone, at intervals of about 10 days from 1st May to 27th June 1928. As a result, 91 per cent. of uninfested fruit was harvested from one variety of peach (as compared with 49 per cent. in the remainder of the orchard, which was sprayed in accordance with the Ohio schedule), 100 per cent. from another variety and 79 per cent. from a third, the last, a late variety, having received two additional applications of lime on the 7th and 14th July. The nicotine is considered a negligible factor in these results. In a young orchard without fruit, regular weekly treatments with hydrated line (25 lb. to 50 U.S. gals.) reduced twig injury by 53 per cent. for the whole season.

In making new plantations, it would be better to separate as widely as possible early and late varieties, since the larvae maturing in late fruit are the ones that hibernate. The interplanting of peach and apple should be restricted, because this moth is able to become an apple pest when the peaches have been harvested.

HAEUSSLER (G. J.). **The Oriental Peach Moth.**—*Trans. Peninsula Hort. Soc. 1929*, pp. 80–86. Dover, Del., 1929.

A brief account is given of the oriental peach moth [*Cydia molesta*, Busck] and the problems of its control [*R.A.E.*, A, xv, 188 ; xvii, 42, etc.]. Remedies against the egg stage are not very promising ; many and thorough applications of insecticides are necessary if the eggs are to be killed by a contact spray. Nicotine or white oil emulsions will kill numbers of eggs or newly hatched larvae ; the nicotine may be incorporated into the regular spray schedule for peaches, but for the later varieties one or two additional applications are necessary. Against the larvae, it is essential to maintain a spray or dust in the deep depression about the stem of the fruit, where many of the small larvae enter, and this is almost impossible. Experiments are being made with substances used as physical or mechanical hindrances to the larvae crawling over the fruit, and these at present seem promising [*cf.* preceding paper]. Cultivation in the spring shortly before emergence of the first moths, that is, usually from 1 to 3 weeks before blossoming of peaches, will kill the insects wintering in cocoons on the ground. Certain chemicals are also being tested as repellents against oviposition. The method of parasitism of the larva by *Macrocentrus ancylivora*, Roh., which is probably present in Delaware and Maryland, is described ; this species

is abundant in southern New Jersey, where 75–90 per cent. of the larvae of the first two generations are sometimes attacked, but is scarce in the north of the State, where *Glypta* [*rufiscutellaris*, Walsh] is the more numerous parasite. An attempt has been made to introduce the former species into some localities where it is not at present known. Parasites of the larvae of *C. molesta* are largely confined to those feeding in the twigs. The egg parasite, *Trichogramma minutum*, Riley, also occurs in southern New Jersey.

HEADLEE (T. J.). **Some Phases of Codling Moth Control.**—*Trans. Peninsula Hort. Soc. 1929*, pp. 87–94. Dover, Del., 1929.

The following is taken from the author's summary and is based on work in New Jersey [*cf. R.A.E.*, A, xvii, 370]: Before spring the rough bark of trees infested with the codling moth [*Cydia pomonella*, L.] should be scraped off and burnt. Arsenical treatment should be given when the blossom falls, and attack should then concentrate on the first generation larvae. A first cover spray should be applied, thoroughly coating the leaves above and below, when half the overwintered generation of moths has emerged. This coating should be maintained by repeating when necessary until this generation has all emerged, thus reducing injury to 2 per cent. or less. If the injury is still above 2 per cent., a cover spray should be applied one week before half of the summer generation of moths has emerged, and this covering should be maintained throughout the period of entry of the resulting larvae. If the injury is less than 2 per cent., sulphur-arsenical dust treatments should be given to avoid spray residues. The dust should be applied from one side one week before half the summer generation has emerged, and again in the following week from the other side, similar applications being continued weekly until the entry of the larvae of this generation has ceased.

CORY (E. N.). **Control Measures for the European Red Mite on Peach and Apple.**—*Trans. Peninsula Hort. Soc. 1929*, pp. 109–110. Dover, Del., 1929.

The most successful remedies against the European red mite [*Paratetranychus pilosus*, C. & F.] in Maryland are applied to the egg stage during winter and early spring, the eggs being most susceptible during their period of development before hatching begins. Oil sprayed at the delayed dormant period is almost essential for control, followed on apples by regular dilute lime-sulphur sprays during the growing season. If the mites become numerous, however, the injured foliage is more susceptible to scorching by lime-sulphur, and the usual dilution (1 : 40) cannot be used. On peach, the dormant application of oil must be relied on almost entirely; particulate sulphur has proved efficient in California under conditions of high moisture and temperature, but is not successful in Maryland.

BUTLER (H. G.) & DOZIER (H. L.). **Life History Studies of the Plum Curculio.**—*Trans. Peninsula Hort. Soc. 1929*, pp. 111–117, 3 figs. Dover, Del., 1929.

A brief sketch is given of the life-history of *Conotrachelus nenuphar*, Hbst., as occurring in Delaware, where recent studies have revealed no

evidence of a second generation. The large number of larvae taken from fallen peaches shows the importance of the removal of these. It has been found that burial of such fruit to a depth of 24 ins. does not prevent the emergence of all weevils, at least in rather light sandy loam ; a liberal application of paradichlorobenzene to the fruit before covering with soil has given excellent results. As over 90 per cent. of the pupae occur at a depth of less than 2 inches below the ground surface, they can easily be reached by cultivation.

Cory (E. N.). **The Mexican Bean Beetle and the Control of the Red Spider on Strawberries.**—*Trans. Peninsula Hort. Soc. 1929*, pp. 154–156. Dover, Del., 1929.

A popular account is given of the Mexican bean beetle [*Epilachna corrupta*, Muls.] with reference to its occurrence in Maryland and Delaware, where a second generation overlaps the first, and a third may occur during favourable seasons. Every effort should be made to kill the beetles after their emergence from hibernation and before oviposition can take place. Calcium arsenate in dust form is the insecticide recommended as being economical in material and labour.

The red spider [*Tetranychus telarius*, L.] has been very injurious to strawberries for some years past. In Delaware, the adult mites live through the winter in the tightly curled leaves of the central bud cluster. There are two types of injury ; the feeding of the mites early in the season weakens the plants and results in a reduced crop, and their feeding on the sepals causes "brown cap." Dusting with fine grade sulphur is the standard remedy against mites and gives excellent results if the strawberry leaves are completely covered on the lower surface. Dusting should begin about the time the green begins to show prominently in the crown (about 15th April), and a coating should be kept on the leaves until the berries are nearly ready to turn pink. Summer and autumn applications do not have much effect.

Guyton (T. L.). **The Japanese Beetle in Pennsylvania.**—*Bull. Pennsylvania Dept. Agric.*, xii, no. 4 (Gen. Bull. 473), 15 pp., 8 figs. Harrisburg, Pa., 1st April 1929.

This is a popular account of the bionomics and control of *Popillia japonica*, Newm. (Japanese beetle), which now occurs more or less generally over the south-eastern portion of Pennsylvania. A recent recommendation against larvae infesting the roots of grass, etc., is that of top-dressing with a mixture of 5 lb. lead arsenate and 1 bushel soil to each 1,000 sq. ft., with a further top-dressing of soil to make $\frac{1}{4}$-inch covering. This dressing should be applied in late summer, but not after 15th September.

Newcomer (E. J.) & Yothers (M. A.). **Biology of the European Red Mite in the Pacific Northwest.**—*Tech. Bull. U.S. Dept. Agric.*, no. 89, 69 pp., 25 figs., 32 refs. Washington, D.C., March 1929.

Paratetranychus pilosus, C. & F. (European red mite), which was first observed in North America in 1911, is now found throughout the eastern portion north of latitude 37° N. and west to Indiana. It is also very

common in the Pacific North-west and occurs southward as far as central California and eastward as far as Utah. In view of its importance as a pest of fruit trees, a thorough, biological investigation was carried out at Yakima, Washington, during the years 1923–25, the results of which are here given. The history and distribution of the mite are discussed, its food-plants are recorded and all stages are described. The injury caused consists of the removal of sap and chlorophyll from the leaves, followed sometimes by defoliation. Apple, pear, prune and plum are the most seriously affected, cherries suffering less, and peach and apricot being comparatively free from attack.

The mite hibernates in the egg stage, the eggs being found on the smaller branches and twigs. The larvae hatch about the middle of April and migrate to foliage to feed. The average incubation period lasted 10 days, larval period 3·5 days, nymphal period 6 days, and pre-oviposition period 2·5 days. The adults deposit summer eggs on the leaves. Six complete and partial seventh and eighth generations occur in a season in the Pacific North-west. Rather fewer eggs were laid by unfertilised than by fertilised females, the unfertilised eggs producing males, and 85·32 per cent. of the fertile eggs hatched as compared with 76·53 per cent. of the parthenogenetic eggs. The females live approximately 15·5 days and oviposit for about 11 days, during which time they generally lay from 20 to 24 eggs. Nearly 80 per cent. of the eggs are laid between 9 a.m. and 5 p.m. at an average temperature of 71° F.

A comparison of the feeding periods of the immature stages of the seven broods with the quiescent periods, during which the mites are more resistant to certain sprays, shows the average length of the latter to be 4·54 days as compared with 4·93 days.

Although no true parasites of *P. pilosus* have been observed, an important part is played in its control by predacious enemies, the chief of those found in the Yakima Valley being the Coccinellid, *Stethorus picipes* Casey, the thrips, *Scolothrips sexmaculatus*, Perg., the Anthocorid, *Triphleps insidiosus*, Say, and a Gamasid mite, *Seius* sp. (probably *S. pomi* Parrott). Detailed studies have been carried out in connection with the life-history and feeding habits of *Stethorus picipes*, which is an active flyer and is more abundant in some orchards than in others. All stages of this Coccinellid are described. The beetles are not observed until after midsummer, but all stages are present in the orchards from late July till October, and there are probably several broods during the season. The incubation period averages 7·29 days, the larval stage 14·29 days and the pupal stage 7·29 days. The larvae and adults feed on all stages of *P. pilosus*, and each Coccinellid consumes several hundreds of mites in the different stages, showing a preference for eggs. Tables are given to show the number of mites and eggs consumed by each stage of the Coccinellid and the effect of temperature and sunlight upon its activities. The process of regurgitation practised by the larva of *S. picipes* in feeding upon the mite is described. The adults eat the shells and skins of the eggs and mites after sucking them dry. One adult confined on a piece of apple with winter eggs only for food consumed 465 in 10 days from 21st to 30th September. *T. insidiosus* feeds upon great numbers of mites and their eggs in all its stages. An adult was observed to kill and devour 12 mites in half an hour. Descriptions of the nymph and adult are given. *Scolothrips sexmaculatus* consumes all stages of the mite, but shows a preference for the eggs. One thrips in the last nymphal stage was observed to consume 55 eggs, 34 larvae,

7 nymphs and possibly 6 adults in 3 days. *Scius* sp. has been found only occasionally in the Yakima Valley, and though it feeds on both summer and winter eggs of *P. pilosus*, appears to prefer *Tetranychus telarius*, L. This Gamasid occasionally attacks the larval and nymphal mites, but never the adults.

TIMBERLAKE (P. H.). **Three new Species of the Hymenopterous Family Encyrtidae from New South Wales.**—*Univ. Cal. Pub. Ent.*, v, no. 2, pp. 5–18, 5 figs. Berkeley, Cal., 30th March 1929.

Anusoidea comperei, sp. n., and *Tetracnemus pretiosus*, sp. n., which are described from New South Wales, were reared from *Pseudococcus gahani*, Green, and the latter is now being propagated and colonised in large numbers in California [see next paper]. A closely allied species of *Tetracnemus* reared from *Pseudococcus* sp. in New Zealand was recorded in an unpublished paper by L. O. Howard years ago ; the characters distinguishing this species are indicated and it is named *T. brounii*, sp. n. *Anarhopus sydneyensis*, gen. et sp. n., of which only the female is described, was not reared from a definite host, though obtained from mealybug material collected in a *Citrus* orchard; a female oviposited freely in both *Pseudococcus gahani* and *P. adonidum*, L. (*longispinus*, Targ.), but no progeny resulted.

SMITH (H. S.) & COMPERE (H.). **New Insect Enemies of the Citrophilus Mealybug from Australia.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 3, pp. 214–218. Sacramento, Cal., March 1929.

Most of the information contained in this paper concerning six species of natural enemies of *Pseudococcus gahani*, Green (citrophilus mealybug) introduced into California from Australia has already been noticed [*R.A.E.*, A, xvii, 72]. Their true value will depend on their ability to reduce the overwintering broods of *P. gahani* sufficiently to prevent the appearance of spring and summer infestations. Recoveries in July and August 1928 of *Coccophagus* [*gurneyi*, Comp.], *Tetracnemus* [*pretiosus*, Timb.] and *Diplosis* from *P. gahani* are recorded. In one *Citrus* grove in which liberations of *Cryptolaemus* [*montrouzieri*, Muls.] failed to reduce the numbers of *P. gahani*, it was successfully controlled by the liberation of the newly introduced parasites at the end of July and had become scarce at the beginning of September. Of 49 mealybugs collected in $1\frac{1}{4}$ hours on 12th September 1928 from trees in this grove, 24 were inhabited by the larvae or pupae of *Coccophagus* or *Tetracnemus*.

SMITH (R. H.). **Experiments with Oil Sprays in controlling the Red Scale.**—*Citrus Leaves*, ix, no. 3, pp. 4–5. Redlands, Cal., March 1929.

An account is given of experiments undertaken to discover a means of controlling the red scale [*Chrysomphalus aurantii*, Mask.], the most resistant to oils of the Coccids attacking *Citrus* in California, by the use of sprays other than those containing heavy oils (90–110 seconds viscosity), which are not suitable for application to orange trees. Tests carried out 3 years ago indicated that viscosity is an important factor in determining the efficiency of oil sprays. Oil of 50 seconds viscosity

gave the poorest results, when applied at 1 and 2 per cent. strengths, whereas progressively improved control was secured by the application of oils of 80 and 120 seconds viscosity. Paraffin base oil of 70 seconds viscosity appeared to be as effective as naphthene base oils of 80 and 120 seconds viscosity. The fact that many live Coccids were present on the sprayed trees 3 months after treatment with 2 per cent. sprays was probably due to imperfect coverage, though in some cases they may have been hit and the thickness of the oil deposited may have been insufficient to be fatal. Results of laboratory tests in spraying infested lemons indicate that oil of approximately 80 seconds viscosity or more, used at 2 per cent. strength, would be required to control *C. aurantii.* Difficulty was experienced in securing uniform results owing to inequalities in the thickness of the film of oil deposited on different parts of the fruit. In tests in which $\frac{1}{4}$ per cent. strength of oil was used, doubling the amount of spray applied resulted in a marked increase in killing effectiveness. Field experiments in which an endeavour was made to increase the effect of highly refined oils by the addition of toxic substances such as nicotine or pyrethrum gave unsatisfactory results. A highly refined kerosene was used (95 per cent. unsulphonated residue, 30 seconds viscosity). No adequate reason was discovered to account for the slightness of the increase in killing efficiency secured, though it has been suggested that rapid evaporation accounts for the relative ineffectiveness of kerosene against *C. aurantii.*

De Gryse (J. J.). **Notes on the Control of the Forest Tent Caterpillar** (*Malacosoma disstria*).—*19th Ann. Rep. Quebec Soc. Prot. Plants 1926–27*, pp. 17–18. Quebec, 1927.

Extensive outbreaks of *Malacosoma disstria*, Hb., occurred in Saskatchewan in 1924 and 1925, when numerous experiments on its control were carried out. On valuable shade trees or on orchard trees, a spray of 1 U.S. gal. miscible oil, 1 lb. sodium arsenate and 15 U.S. gals. water gave practically 100 per cent. control when applied to egg-masses 1–2 weeks before the hatching period, the trees suffering no harm. Eggs that occur in places remote from the food-plant need not be treated, because when these hatch, the larvae nearly always die of starvation through their inability to crawl more than 6 or 7 feet. Another spray, consisting of $\frac{3}{4}$ pint 40 per cent. nicotine sulphate and 40 gals. water applied as soon as all the caterpillars had hatched always gave complete control, larvae up to the fourth instar being readily killed. Equally good results were obtained with nicotine sulphate dust, 5 per cent. to 95 per cent. hydrated lime.

In the forest, however, natural control must be depended on. It was found that when insect parasitism amounted to over 90 per cent. in any area, the end of infestation could safely be predicted for that locality. The transfer of parasitised cocoons from one district to another might prove effective ; cocoons formed on buildings, tree trunks or similar unprotected situations, especially in newly infested areas, are more readily parasitised by Ichneumonids than those spun between leaves.

Gibson (A.). **Fighting the Insects.**—*Civil Service Rev.*, i, no. 4, pp. 282–287, 5 figs. Ottawa, March 1929.

This is a popular account of Government work against insect pests in Canada, where it is estimated that from 10 to 25 per cent. of the standard

crops are destroyed every year, involving an annual loss of over £20,000,000. A list of the research laboratories and plant inspection stations is given, and the chief insect pests are briefly reviewed. The organisation of various types of control is outlined, including dusting with aeroplanes, introduction of parasites, investigation of insecticides, eradication of insects injurious to health, and the inspection of imported plants.

Ontario : The Corn Borer Act, 1925, as amended in 1926, with Regulations (Order-in-Council, 26th July 1926). 3 pp. Toronto, 1926. [Recd. 1929.]

This Act for the eradication of the European corn borer [*Pyrausta nubilalis*, Hb.] in Ontario provides for the appointment and details the powers of inspectors.

Under the Order-in-Council all stalks, pieces of stalks and cobs of each year's maize crop, if not fed, ensiled, shredded or mixed with manure, must be burned or completely ploughed under. When maize stalks, etc., are mixed with manure, the top eight inches of the surface must be removed and burned, or ploughed under, or covered to a depth of four inches with earth or well-rotted manure, free from maize stalks or any parts of plants capable of concealing the borers. This covering must remain intact until 1st July. All maize, whether shelled or on the cob, must be stored in a dry place after 20th May. All maize stubble must be ploughed under. No wheat, or any autumn or spring crop, may be sown immediately after a maize crop, until all the remnants of the latter are disposed of. All control measures must be completed by 20th May of the year succeeding the crop.

Briand (L. J.). **Laboratory Breeding of the European Corn Borer (*Pyrausta nubilalis* Hubn.) with special Reference to Equipment and Cages.**—*Canad. Ent.*, lxi, no. 3, pp. 51–54, 8 figs. Orillia, Ont., March 1929.

Methods of rearing the larvae of *Pyrausta nubilalis*, Hb. (European corn borer) in large numbers for use in breeding parasites such as *Microgaster tibialis*, Nees, *Eulimneria alkae*, Ell. & Sacht. (*crassifemur*, auct.), *Macrocentrus gifuensis*, Ashm., and *Apanteles thompsoni*, Lyle, that attack the young larvae are described. *M. tibialis* has been bred successfully during the last two years, but work with the other three species is still in the experimental stage. All material is incubated at a temperature of 85° F., with a relative humidity of 60 per cent. or higher, as these conditions have been found to be the most satisfactory. Since all young larvae reared in the laboratory are used in breeding the parasites, full-grown larvae collected in the field are used for the rearing of moths for egg production. The cages used for this part of the work consist of lantern globes closed at both ends with fine-meshed wire screening to facilitate the air circulation and containing strips of corrugated cardboard one inch wide placed side by side. Not more than 200 larvae are placed in a cage, which is immersed in water for 5–10 seconds before being placed in the incubator. The excess water is drained off and the amount of water absorbed by the cardboard supplies sufficient moisture for pupa-

tion, which takes place in the corrugations. Mortality among the larvae varies from 5–10 per cent. ; the material is examined two or three times a week and the few dead larvae removed so that they do not contaminate the healthy individuals. From overwintered larvae the moths begin to emerge in three weeks' time, but larvae collected during the summer or autumn require a much longer period for transformation. Emergence occurs over a period of about two weeks, the moths being removed daily and placed in oviposition cages.

The most successful type of oviposition cage is made of two disks of laminated wood $\frac{1}{4}$ in. thick and 5 ins. in diameter, held apart by 4 stiff wires equidistant from each other on the circumferences. The disks are suspended in a small frame by means of two short horizontal central axles, on which they revolve. The frame also supports three rollers. A roll of waxed paper is placed on the top roller, the paper is run over the second roller, round the four wires and out over the third roller, which is close to the second, the end of the paper being held in place by clipping it to a wire rod on the frame. An oblong cage 12 ins. long by $3\frac{1}{2}$ ins. square is thus formed ; the wooden ends are covered inside with wire screening to prevent the moths from laying eggs on that part of the cage. Two wire screen cylinders, 1 in. long and 1 in. in diameter, to hold moistened cotton wool, are also attached to the ends. The lower roller, which is hinged and removable, serves as a door to the cage. When opened it gives an aperture $2\frac{1}{2}$ ins. wide, and when it is closed against the second roller, the distance between them is just enough to allow the egg-masses on the waxed paper to pass without being crushed. The paper on which they are deposited can thus be drawn out over the lower roller by pulling on the lower edge of the paper, and is automatically replaced from the top roller. Each day when the dead moths are being removed and replaced by freshly emerged ones, a light is placed on the side of the cage opposite the opening, and the moths, which are positively phototropic to artificial light, are held in the cylinder by the light through the waxed paper, very few flying out. About 40 females and 30 males are placed in each cage. If kept in the incubator, the females begin to oviposit 4–5 days after emergence and live for 10–12 days. Since the moths are active in the dark, it is necessary to cover the cage with heavy dark paper. Seven of these cages are used, and, being even in size, can be piled on top of each other, thus occupying very little space in the incubator. A larger cage with a cylinder measuring 36 ins. in length by 15 ins. in diameter and having a capacity of 1,500 moths has proved equally satisfactory.

The eggs are removed every morning and left in the incubator for 2–3 days until they are ready to hatch, when they are cut from the paper and placed in 4-inch flower-pot saucers with food ; a second saucer is inverted over the top, the edges of the saucers being ground to ensure a close fit. Before being used the saucers are immersed in water for 24 hours, the water absorbed by the pottery supplying sufficient moisture for the hatching of the eggs. Twenty egg-masses are placed in each container, which is then placed in the incubator. They are kept in the incubator until the larvae have reached the proper stage for parasitism ; this usually takes 4–5 days, during which period it is necessary to examine them daily and replace decaying food. After the third instar, the larvae are separated on account of their cannibal habits and placed in 2-inch glass vials with wire screen stoppers to provide for ventilation. A list is given of the food materials tested, curled dock (*Rumex crispus*) and string beans proving two of the most satisfactory.

Ogilvie (L.) & Guterman (C. E. F.). **A Mosaic Disease of the Easter Lily.**—*Phytopathology*, xix, no. 3, pp. 311–315, 6 refs. Lancaster, Pa., March 1929.

A virus disease of the mosaic type is recorded on the Bermuda Easter lily, *Lilium harrisi*. Experimentally it was not transmitted by *Aphis gossypii*, Glov., *A. ogilviei*, Theo., *Empoasca* (*Empoa*) *fabae*, Harr., or *Cicadula sexnotata*, Fall., the insects that occur most commonly in the lily fields of Bermuda, or by *Rhizoglyphus hyacinthi*, Banks.

[**Froghopper Investigations.**]—*Min. & Proc. Froghopper Invest. Comm., Trinidad & Tobago*, pt. xiv, pp. 175–222, 6 figs. Trinidad, 1929.

In addition to brief reports on the progress of investigations, a survey is given of the present position as regards the possibilities of biological control of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] in Trinidad, with notes on the incidence of the pest at a particular locality during 1928.

Borgmeier (T.). **Um caso de trophobiose entre uma formiga e um parasita do caféeiro.** [A Case of Trophobiosis between an Ant and a Pest of Coffee.]—*Bol. Mus. nac. Rio de Janeiro*, iii, no. 4, pp. 285–289, 1 pl., 2 refs. Rio de Janeiro, 1927. [Recd. 1929.]

A description is given of *Acropyga pickeli*, sp. n., which fosters the Coccid, *Rhizoecus coffeae*, Laing, infesting coffee in the state of Parahyba, Brazil [*cf. R.A.E.*, A, xvi, 382].

Bondar (G.). **As manchas em laranjas, causadas pelos acarideos.** [The Spotting of Oranges due to Mites.]—*Correio agric.*, v, no. 4, pp. 67–69, 1 fig. Bahia, April 1927. [Recd. 1929.]

The leaves and fruits of oranges in Bahia are injured by the mites, *Phyllocoptes* (*Eriophyes*) *oleivorus*, Ashm., *Anychus* (*Tetranychus*) *banksi*, McG., and *Tenuipalpus californicus*, Banks. These species are briefly described, with notes on the manner in which they attack the plants, and sprays of Bordeaux mixture or dusts of sulphur are suggested for their control.

Bondar (G.). **Um membracideo**—*Hoplophora porosa* **Wlr. em laranjeiras. Thrips nas laranjeiras.** [A Membracid, *Hoplophorion pertusa*, Germ., on Oranges. Thrips on Oranges.]—*Correio agric.*, v, no. 5, pp. 90–91, 2 figs. Bahia, May 1927. [Recd. 1929.]

Spraying with a 3 per cent. solution of carbolineum is advised against the larvae and adults of the Membracid, *Hoplophorion pertusa*, Germ. (*Hoplophora porosa*, Wlk.), attacking young twigs of *Citrus* in Bahia. The foliage of oranges is attacked by *Heliothrips haemorrhoidalis*, Bch., but more harm is done by *Frankliniella* sp. and *Scirtothrips* sp. living in the flowers.

Box (H. E.). **El Brúquido del Poroto** (*Bruchus obtectus*, **Say**). [The Bean Bruchid.]—*Rev. ind. agric. Tucumán*, xix, no. 5–6, pp. 146–154, 7 figs. Tucumán, 1928.

This account of the bionomics and control of *Bruchus obtectus*, Say, which is a pest of stored beans in Argentina, is based largely on the author's previous paper [*R.A.E.*, A, x, 448].

[Mordvilko (A. K.).] **Мордвилко (А. К.). Die anolozyklischen Pistazien-Blattläuse und die Verbreitung der Pistazien in der Tertiärzeit.** [The anholocyclic Pistachio Aphids and the Distribution of the Pistachios in the Tertiary Epoch.]—*C.R. Acad. Sci. U.R.S.S.*, 1929, no. 3, pp. 61–66, 10 refs. Leningrad, 1929.

In continuation of his previous papers [*R.A.E.*, A, xv, 652 ; xvi, 52 ; xvii, 264], the author further discusses the evolution of anholocyclic forms of Pemphigine Aphids, following the disappearance of their primary food-plants.

The Aphids attacking four of the eight species of *Pistacia* (*P. terebinthus*, *P. mutica*, *P. lentiscus* and *P. vera*) are known, and the author discusses their distribution and that of their corresponding anholocyclic forms, thereby indicating the previous distribution (chiefly in the tertiary epoch) of the trees. He considers that if the Pemphigines attacking the other species of *Pistacia* were known, a complete map of the distribution of the trees of this genus in tertiary times could be made. A comparison is drawn between the former and the present areas of distribution of *Pistacia*, and the obvious decrease of the latter is pointed out.

[Megalov (A.).] **Мегалов (А.). The Pests and Diseases of Orchards and their Control.** [*In Russian.*]—[*Pub.*] *Sta. Zashch. Rast. Vredit.* [*Pub. Saratov Sta. Prot. Plants*], no. 19, 67 pp., 52 figs.

[Megalov (A.).] **Мегалов (А.). The chief Pests and Diseases of Vegetable Crops and Melons and their Control.** [*In Russian.*]—[*Pub.*] *Sta. Zashch. Rast. Vredit.* [*Pub. Saratov Sta. Prot. Plants*], no. 31, 39 pp., 22 figs. Saratov, 1927. [Recd. 1929.]

Popular notes are given on the morphology and biology of the chief insect pests of fruit and vegetable crops in the Saratov Government and on measures for their control. The preparation and employment of the more important sprays and dusts are discussed in detail, and various types of spraying and dusting equipment are described.

[Popov (P.) & Startzeva-Klementz (A.).] **Попов (П.) и Старцева-Клеменц (А). Short Key to the chief Pests of Oil-producing Plants.** [*In Russian.*]—[*Pub.*] *Sta. Zashch. Rast. Vredit.* [*Pub. Saratov Sta. Prot. Plants*], no. 37, 11 pp., 19 figs., 9 refs. Saratov, 1928.

A list is given of insects damaging sunflowers, mustard, hemp, flax and Siberian oil-seed [*Camelina sativa*] in Saratov, with popular descriptions of the stages in which they injure the plants, and notes on the parts attacked.

[Grossheĭm (N. A.) & Pyatakova (V. L.).] **Гроссгейм (Н. А.) и Пятакова (В. Л.). A preliminary List of Orchard Pests of the Mleev Experiment Station District (1923-1927).**—*Bull. Mleev Hort. Expt. Sta.*, no. 5, 30 pp. Mleev, 1928.

This is an extensive list of insect pests of fruit that occurred in the district of the Mleev Experiment Station (Kiev Government) during the years 1923–27, with particulars of their food-plants and synonymy.

[Grossheĭm (N. A.).] **Гроссгейм (Н. А.). Programme of the Entomological Section of Mleev Experiment Station.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 7, 15 pp. Mleev, 1928.

The work of the entomological section of an experiment station should be based on investigations on the bionomics, ecology, and economic status of insect pests ; observations on the plants attacked and their reaction to infestations ; and a study of control measures and of the economic aspects of their application. These points are discussed in detail, and a provisional programme is drawn up for the Mleev Experiment Station.

[Rodendorf (B. B.).] **Родендорф (Б. Б.). Flies of the Family Sarcophagidae, Parasites of Acrididae.** [*In Russian.*]—[*Pub.*] *Uzbekistansk. opuitn. Stantz. Zashch. Rast.* [*Pub. Uzbekistan Sta. Prot. Plants*], no. 14, 64 pp., 26 figs., 2 refs. Tashkent, November 1928.

Brief notes are given on the characters distinguishing the Sarcophagids, Bombyliids, Anthomyiids and Chloropids. The characters of the family Sarcophagidae are described in detail, and a key is given to the genera of the subfamily Sarcophaginae, with descriptions of the genera *Blaesoxiphella*, *Sarcophila*, *Oophagomyia*, gen. n., and *Locustaevora*, gen. n. Each of these genera contains only one species, and these comprise : *B. brevicornis*, Villen., recorded from the Samara, Irkutsk and Orenburg Governments and parasitising the adults of *Omocestus haemorrhoidalis*, Charp., and *Chorthippus* (*Stauroderus*) *scalaris*, F. W. ; *S. latifrons*, Fall., from Siberia, Turkestan and Mongolia and common throughout Europe, parasitising *Gomphocerus sibiricus*, L., *Dociostaurus* (*Stauronotus*) *maroccanus*, Thnb., and *Locusta migratoria*, L. ; *Oophagomyia plotnikovi*, sp. n., from Turkestan, the southern Altai Mountains and the North Caucasus, parasitising the egg-pods of *L. migratoria* ; and *Locustaevora migratoriae*, sp. n., from Tashkent, a parasite of the larvae and adults of *L. migratoria*.

The characters distinguishing the two subgenera of *Blaesoxipha* are given, and the species of this genus, including five new ones, are described. Those of which the hosts are known are : *Blaesoxipha asiatica*, sp. n., recorded from the Tobolsk Government, parasitising the egg-pods of *Arcyptera microptera*, F. W. (*Stethophyma flavicosta*, Fisch.), and *Podisma* (*Pezotettix*) *pedestris*, L. ; *B. filipjevi*, Rohd., from Daghestan, *B. grylloctona*, Lw., from Turkestan, Daghestan, Astrakhan and Eastern Siberia, and *B. tertia*, sp. n., from Turkestan and Persia, all recorded from *Locusta migratoria* ; and *B.* (*Gesneriodes*) *lineata*, Fall., which is a very common species in southern Europe, western Asia, Turkestan and Siberia, and is the chief parasite of the majority of injurious locusts.

A key is given to the species of the genus *Sarcophaga* that have been recorded in the literature as parasites of ACRIDIDAE, but the author thinks that their parasitism of these hosts is doubtful. Brief notes are given on the distribution of the Sarcophagids in the Palaearctic region, and it is pointed out that most of them occur in Central Asia.

[PROZOROV (S. S.).] **Прозоров (С. С.). Die Brandflächen in Kiefernbeständen als Ansteckungsherde.** [Burnt Areas in Pine Forests as Foci of Infestation.] [*In Russian.*]—*Trud. sib. Inst. Sel.-Khoz. Lesovod.*, xii, pt. 3, reprint 54 pp., 17 figs.; 6 graphs, 28 refs. Omsk, 1929. (With a Summary in German.)

In Siberia, 67 per cent. of the trees are coniferous, and the forests are generally uncleared, so that forest fires, which usually occur in May, June and August, result in vast burnt areas that offer very favourable conditions for outbreaks of bark-beetles. A detailed account is given of investigations made in 1925 and 1927 in a coniferous forest in the Altai region. The insect fauna of the burnt areas is reviewed, and lists are given of the more common species of Coleoptera that occurred there.

The most important pest is *Ips sexdentatus*, Boern., which has a partial second generation. The over-wintering adults oviposit once in May and twice in June. The larvae from the eggs laid in May pupate and emerge as adults in June, ovipositing in July. These eggs give rise to young adults in August, which hibernate. The eggs laid in June give rise to adults in July; these lay a few of their eggs in August and then hibernate, some in galleries under the bark or in the cambium, but the majority in the soil under the infested trees at a depth of about an inch. The beetles infest the thicker part of the trunks, usually not higher than 25 ft. from the ground, and prefer trees that have been damaged by fire, but under crowded conditions they also attack healthy trees. The spring generation is the most numerous; the number of eggs laid during the second oviposition is considerably less, and the resulting beetles are less vigorous. Usually the period of oviposition and of the resumed feeding of the over-wintered adults lasts 20–25 days, after which they lay eggs for a second time. The development of *I. sexdentatus* is usually completed in about 6–8 weeks; the egg, larval and pupal stages last about 5, 7 and 6 days, and the maturation feeding 18 days.

Ips acuminatus, Gyll., is next in importance as a pest in burnt areas, and often occurs as a primary pest of almost healthy pines, thus lowering their resistance to the attacks of other bark-beetles. It usually infests the part of the trunk between 25 and 80 ft. from the ground, but it is also often abundant in branches of standing and felled trees. Its development is very similar to that of *I. sexdentatus*.

Myelophilus (*Blastophagus*) *minor*, Htg., and *M.* (*B.*) *piniperda*, L., are on the wing earlier than other Scolytids, and their eggs may be found in galleries in the beginning of May. The larvae appear about 10th May and make long galleries immediately under the bark, gradually penetrating into the wood. The first pupae occur in these at the beginning of June, and about 20th June the first young adults emerge. The mass flight takes place at the end of July, but the maturation feeding starts in the beginning of the month, when the beetles attack thin twigs on the crowns of pines, causing them to dry and fall. *M. minor* usually infests the central part of the trunk where the bark is thin, whereas *M. piniperda*, which is of less frequent occurrence, prefers the thick part, within about 16 ft. of the ground. The activity of *M. minor* is to

a certain extent checked by *Crypturgus cinereus*, Hbst., which destroys all stages in the galleries [*cf. R.A.E.*, A, xiv, 608].

Dendroctonus micans, Kug., usually attacks spruce, but in the forest under review it infested isolated, old pines to a considerable extent near the junction of the trunk and the roots and within 3 ft. of the ground. The larvae occurred from the middle of July till the middle of August.

The Lamiid, *Monochamus galloprovincialis*, Ol., is responsible for the dying off of vast areas of pine forests. The adults are on the wing by the end of June, the mass flight occurring in the middle of August; each female deposits 11–24 eggs in holes made in the bark. Woodpeckers destroy a great number of the larvae, but most of them escape and continue to mine galleries in the sapwood, where they hibernate; pupation and emergence of young adults occur in the summer of the following year. Prior to laying eggs, the adults attack the needles and the thin bark of the twigs for maturation feeding, causing them to dry and fall. This weakens the tree and lowers its resistance to the attacks of secondary pests. Under crowded conditions the adults also damage the cambium and sapwood.

The adults of another Lamiid, *Acanthocinus aedilis*, L., are most numerous in the middle of May. They oviposit in various layers of the bast of lying or standing trees weakened by fire, each female laying from 2 to 24 eggs. The larvae first mine under the bark and then into the wood, pupating at the end of July, but as they do not penetrate deeper than $\frac{1}{2}$ in., the damage caused to the trees is less than that done by *M. galloprovincialis*. The adults of *Spondylis buprestoides*, L., are on the wing in the second half of June. Oviposition occurs in the middle of July on the roots of pines immediately under the surface of the soil; the larvae mine the roots and remain in the galleries for hibernation. Small numbers of *Pissodes piniphilus*, Hbst., also occur in the Barnaul district, but the damage they cause is insignificant.

The chief types of burnt areas are described and classified according to the month in which the fire started, its intensity and dimension, and the age of the trees. Burnt areas resulting from May fires become infested by *A. aedilis* and *Ips* in June, and in July by the young broods and second generation of the latter; in August the same areas are infested by *M. galloprovincialis*, which is responsible for the complete withering of the trees. The following year the trees that escaped the attacks of this pest become reinfested by the adults of *Myelophilus* and again by those of *Ips* and *A. aedilis*. Burnt areas resulting from June fires are infested in July by young generations of *Ips* and in August are attacked by the adults of *M. galloprovincialis*; many trees, however, remain uninfested till the spring of the following year. The burnt areas after August fires are usually not infested until the following spring. In the course of two years the percentage of trees infested by *I. sexdentatus* and *I. acuminatus* after May fires rose from 15 to 34 per cent.; other pests infested most of the remainder, leaving only 20 per cent. untouched.

A slow fire and the high temperature resulting from burning rubbish, etc., weaken the trees and leave them in a state very favourable for the development of the beetles, whereas a quick running fire that only blackens the bark and the bottom of the trunks, leaving the cambium intact, does not reduce the trees to a state that is attractive to them. On the other hand, large devastating fires, which completely kill the trees, leave dead areas without any suitable food for the pests. Isolated

old pines, separated by deciduous trees, do not attract the beetles, which prefer dense groups of mature or maturing ones. There they develop in great numbers and gradually migrate to adjoining parts of the forest [*cf. R.A.E.*, A, xiv, 58]. Young burnt forests do not harbour any pests; a strong fire kills the seedlings, and after a slight, running fire they soon recover.

The intensity of the infestation of burnt areas depends to some extent on the distance between them and the previous breeding-places [*cf. loc. cit.*]. Fallen trees and rubbish may serve to link together important foci of infestation. If, however, an old burnt area is only slightly infested, it may continue to attract the beetles from adjoining parts of the forest, and as a result newly burnt parts remain uninfested for a certain period. A similar rôle may be played by felled parts of the forest that are left uncleared.

Forest management and organisation for preventing fires are discussed in some detail. All burnt areas should be inspected to determine the order of felling damaged trees according to their liability to infestation. In view of the enormous infestation of the forests, clearing should not be effected immediately after felling ; in most cases it is better to leave the branches and rubbish to attract the beetles and thus prevent them from infesting healthy standing trees. The rubbish must, however, be cleared in time to destroy the young generation. Strips of standing trees and unbarked logs should also be left as traps.

EGGERS (H.). **Fünf neue Borkenkäfer (Ipidae) aus dem Osten.** [Five new Bark-beetles from the East.]—*Ent. NachrBl.*, iii, no. 1, pp. 9–11. Troppau, February 1929.

Descriptions are given of the following new Scolytids : *Hylastes angusticollis* from spruce (*Picea*) in Volhynia ; *Phloeophthorus muricatus* from *Fraxinus ornus* in Bulgaria ; and *Cryphalus latus* from *Picea, Abies* and *Larix, C. mandschuricus* from *Corylus* and *Juglans mandschurica*, and *C. pruni* from *Prunus triloba*, all in Ussuri (Russian Far East).

Die Insekten.—*Brehms Tierleben*, Bd. vii, Cr. 8vo, 544 pp., 72 pls. Leipzig, Philipp Reclam jr., 1929. Price, cloth *M.* 6, half-leather *M.* 8.

This volume on insects is one of eight forming the new jubilee edition of Brehm's Natural History originally issued in 1863, when the insect section was written by E. Taschenberg, and follows the principles laid down by the latter, though the subject matter has been entirely recast by C. W. Neumann. It is profusely illustrated, and special attention is given to injurious species, nearly all the insects discussed being European.

HABERMEHL (H.). **Eine neue Ichneumonide als Feind der Rübenfliege (*Pegomyia hyoscyami* Panz.) und der Salatfliege (*Chortophila gnava* Meig.=*Anthomyia lactucae* Bouché).** [A new Ichneumonid as an Enemy of the Beet-fly, *P. hyoscyami*, and the Lettuce-fly, *Phorbia gnava*.]—*Deuts. ent. Z.*, 1928, no. 4, pp. 336–337. Berlin, 5th December 1928.

Phygadeuon pegomyiae, sp. n., is described from the pupae of *Pegomyia hyoscyami*, Panz., and *Phorbia* (*Chortophila*) *gnava*, Mg., in Germany.

Bremer (H.). **Die Zuckerrübe und ihre Schädlinge. Rückblick und Ausblick.** [The Sugar-beet and its Pests. Retrospect and Prospect.]—*Die deuts. Zuckerrind.*, 1927, no. 19, reprint 2 pp. Berlin, 1927.

Sugar-beet is the most recent crop to be cultivated on a large scale in Germany, and the period of 120 years during which it has been grown is quite short biologically. About the beginning of the present century the beet-fly [*Pegomyia hyoscyami*, Panz.] and the beet Silphid [*Blitophaga opaca*, L.] began to cause widespread injury. The fly appears to be favoured by cool summers; in warmer regions than the North German Baltic coast Hymenopterous parasites keep it in check. The summer generation can be combated with sweetened poison baits. Outbreaks of the beet-fly occur over large areas, whereas those of the Silphid, which is distributed through a northern zone (Pomerania, Mecklenburg, Brandenburg), are usually much more restricted in extent. While the adaptation to beet of these two pests can only be presumed, that of the beet leaf bug [*Piesma quadrata*, Fieb.] is actually taking place. The first reports of injury by this Tingid date from 1907. It has a somewhat southern range in Germany, but nothing is known regarding its dependence on climate, favourable conditions during the winter, such as warm, dry places in light soil under trees or bushes, being the most important factor. Chrysomelid beetles, usually found on *Atriplex*, attack beet when food is scarce. In view of the increase in the number of beet pests during the past 20–30 years, wild species of *Atriplex* seem to constitute a special source of danger.

Göhler (H.). **Ist dieser Winter ein Schädlingsvernichter?** [Is this Winter a Destroyer of Insect Pests?]—*Die kranke Pflanze*, vi, no. 3, pp. 38–40. Dresden, March 1929.

In view of the severity of the past winter in Germany, the effect of cold on insects is discussed, and it is pointed out that it is sudden, violent changes of temperature that prove fatal, as native insects can withstand extreme cold provided that the transition to and from it is gradual.

Strawiński (K.). **Chloropikryna, jako środek owadobójczy.** [Chloropicrin, a powerful Insecticide.]—*Doświadczaln. Rolniczego*, iv, pt. 2, reprint 4 pp. *Sine loco*, 1929. (With a Summary in French.)

This is a detailed discussion on the composition and properties of chloropicrin, and experiments made with this insecticide in various countries are reviewed. Its manufacture on a commercial scale has only recently been started in Poland.

Strawiński (K.). **Zieleń paryska oraz zastosowanie jej w walce ze szkodnikami roślin.** [Paris Green and its Application in the Control of Insect Pests.]—[*Pub.*] *Stacja doświadcz. Ochrony Roślin w Zgierzu* [*Pub. Sta. Pl. Prot. Zgierz*], no. 1, 15 pp., 5 figs., 1 ref. Zgierz, 1929.

The composition and properties of Paris green are discussed in detail. Instructions are given for its employment in the preparation of liquid and dust insecticides, and the technique of spraying, dusting and the use of poisoned baits is described.

Strawiński (K.). **Gąsienice na kapuście i tępienie ich środkami chemicznemi.** [Caterpillars on Cabbage and their Control by chemical Measures.]—[*Pub.*] *Stacja doświadcz. Ochrony Roślin w Zgierzu* [*Pub. Sta. Pl. Prot. Zgierz*], no. 2, 9 pp., 3 figs. Zgierz, 1928.

This is a popular account of *Pieris brassicae*, L., *P. rapae*, L., and *Barathra* (*Mamestra*) *brassicae*, L., which are the chief cabbage pests in Poland. The larvae and adults are described, and brief notes on their bionomics are given. The second generation of the Pierines does the chief damage, as the larvae of the first feed on weeds; in Poland *P. rapae* has sometimes three generations a year. The larvae of *B. brassicae* attack a variety of wild and cultivated plants. Young individuals infest the lower surface of cabbage leaves, and the mature ones penetrate into the heads, which they mine, causing the plant to rot. They hibernate as pupae in the soil, the adults emerging in spring or early summer. The eggs are laid in batches on the lower surface of the leaves in July and August; one female may lay as many as 1,000–1,500.

These pests may be controlled by the use of Paris green, either as a spray (1 lb. to 2 or 3 lb. lime and 120 gals. water), or as a dust (1 part to 15 parts lime and 5 parts rye flour). At least 7–10 days should elapse between the application of Paris green and the use of the cabbage for food. Against *P. brassicae* and *P. rapae* the insecticide should be applied in July, August and September, and against *B. brassicae* in July and August, before the larvae infest the centres of the cabbage heads.

Rozsypal (J.). **Škůdce jahod zobonoska kovova** (*Rhynchites aenovirens* **Mrsh. v.** *fragariae*). [*Rhynchites aenovirens*, a Pest of Strawberries.]—*Ochrana Rostlin*, ix, no. 1, pp. 1–5, 6 figs. Prague, 1929.

A list of the weevils infesting strawberries in Czechoslovakia is given, *Anthonomus rubi*, Hbst., and particularly *Rhynchites aenovirens*, Mrsh., the adults of which are briefly described, being the most important. The adults of *A. rubi* emerge from hibernation early in the spring and oviposit in the flower buds of strawberry, which they pierce, laying one egg in each. They then feed on the stem below the bud, causing it to wither and sometimes to fall. The larvae live and pupate inside the buds, and the resulting adults emerge in June or July, but do not do serious damage to the old plants before hibernating. The adults of *R. aenovirens* oviposit in the parenchyma of the leaves and in the flower stems in spring, then feeding on the latter and causing them to dry and fall. The larvae mine in the infested parts for about 4 weeks and then pupate in the soil. Many of the adults of *R. aenovirens* are killed by the fungus, *Beauveria bassiana*. Collecting and burning the withered and fallen parts of the strawberry plants seem to be the best means of controlling this weevil, but must be carried out simultaneously in all the infested districts. Sprays and dusts are not effective, as the hair that covers the stems and leaves of the plants prevents them from reaching the infested parts.

Deshusses (A.) & Deshusses (J.). **Parasites nouveaux. Les mouches de l'endive** (*Ophiomyia pinguis* **Fallen et** *Phytomyza continua* **Hendel).**—*C.R. Acad. Agric. Fr.*, xv, no. 13, pp. 533–537. Paris, 1929.

The Agromyzids, *Ophiomyia pinguis*, Fall., and *Phytomyza continua*, Hendel, are recorded for the first time as pests from Geneva, where they were discovered in 1927 injuring chicory (*Cichorium intybus*). The larvae tunnel in the outer leaves and generally traverse several before pupating in a mine near the base of the plant. Of the two species, which are briefly described, *O. pinguis* is the more abundant and injurious. *P. continua* also attacks endive (*Cichorium endivia*) in the same region. Infestation may be considerably reduced by cutting the leaves as close as possible to the base of the plant in preparing roots for forcing. The distribution of *O. pinguis* is briefly discussed.

De bietenvlieg (*Anthomyia conformis* **Fall.** = *Pegomyia hyoscyami* **Panz.**). [The Beet-fly, *P. hyoscyami*.]—*Vlugschr. Plantenziektenk. Dienst*, no. 43, 3 pp. Wageningen, June 1928.

This is a popular account of *Pegomyia hyoscyami*, Panz., and its control with the sodium fluosilicate bait-sprays successfully used in Germany [*R.A.E.*, A, xv, 205].

Spithost (C.). **Draaihartigheid bij kool.** [Deformed Heart in Cabbage.]—*Versl. Plantenziektenk. Dienst*, no. 54, 24 pp., 4 pls. Wageningen, January 1929.

In Holland the hearts of cabbage and similar crucifers are sometimes seriously deformed as a result of attack by the larvae of the gall-midge, *Contarinia torquens*, de Meij. The larvae, varying in number between 5 and 25 to a plant, attack the heart leaves, the resulting gall causing a twisting of the stem of the leaf. The injury is intensified if rain follows the attack by secondary injury in the form of various rots. The period of susceptibility to attack differs with the variety, but none has been found that does not react to infestation. In tests of various liquid and dust insecticides against the larvae, the best results were obtained by spraying weekly with a solution containing 2 per cent. soap and 1 per cent. methylated spirit. For treatment on a small scale, weekly dusting with naphthalene in fine flakes is recommended. In spite of careful search no eggs of *C. torquens* were found.

In a supplementary note T. A. C. Schoevers describes in detail the manner in which the larvae injure the plants.

Barnes (H. F.). **"Button Top" of Basket Willows.**—*J. Minist. Agric.*, xxxvi, no. 1, pp. 65–71, 2 pls., 2 figs. London, April 1929.

The larvae of the small Cecidomyiid, *Rhabdophaga heterobia*, H. Lw., cause a button-like malformation of the young leaves and buds situated at the ends of willow shoots used for basket-making, and since the matured rods that have been attacked are of little use, there is often a great loss in the value of the crop. There are two main broods each year, which overlap considerably. The main attack of the first brood

produces "buttons" a foot or so from the ground ; considerably higher up are those resulting from the main attack of the second brood. Emergence of the overwintering brood takes place from the beginning of April until the second week in July, and oviposition begins a few hours after emergence. The adults of the next brood are on the wing from the beginning of July until September. The eggs are laid on or near the growing points. The larvae hatch in about a week, and three weeks later the "buttons" are readily observed. As many as 40 larvae have been found in one "button," and though the average number is considerably lower, it may be as high as 30 in some districts and seasons. Usually the larvae remain inside the "button," where they also pupate ; those of the second generation attain their greatest size by October and would normally remain in a resting stage until the following April, but as soon as frosts occur and the weather becomes cold, tits and other birds begin to search for them among the "buttons." As a result some of the larvae are eaten, but large numbers are dropped on to the ground and pupate in the soil. It has been found that under laboratory conditions the larvae can survive the winter in the soil in spite of floods and frosts, the adults emerging normally, though possibly slightly later than usual, in the following year. Eggs may also be laid in male flowers (such malformed catkins are found in early spring on rods two years old and also in August and September on the current year's growth) or on the six or eight lateral buds nearest the end of a shoot ; these buds, which become swollen, contain up to 12 grubs.

The attack is less intense in prolonged wet weather, and the grubs are destroyed by parasitic insects and birds (though the latter, by spreading the grubs in the soil, probably do more harm than good), but these natural agencies do not afford adequate control. Various artificial measures are therefore discussed. The continuous removal of "buttons" by hand and their subsequent destruction is recommended. During late September and October, provided that the weather has not turned cold and the tits have not started to attack the "buttons" and buds, all the grubs are inside the "buttons" and no other stages of the insect are to be found elsewhere. It is therefore suggested that the rods, as soon as they are cut and tied into bolts, should be removed from the osier beds to the pits or stacked on a restricted area near the pits on concrete or cinders, so that the larvae, on leaving the rods and attempting to bury themselves in the sides of the pit or on the stacking ground, could be dealt with by means of suitable contact sprays. All peelings should be burnt. It is usual to start cutting the rods as soon as the leaves have fallen (about November) and to continue until March ; it is pointed out that it would probably pay growers to cut the whole crop as early as possible for a season or two, if by so doing the infestation could be brought to a minimum.

SPEYER (E. R.). **Entomological Report.**—*13th Ann. Rep. Exptl. & Res. Sta., Nursery & Mkt. Gdn. Ind. Devpmt. Soc. 1927*, pp. 60–80. Cheshunt, Herts, 1928. [Recd. 1929.]

The first three sections of this report deal with investigations on red spider [*Tetranychus telarius*, L.] in glasshouses, the greater part of the information contained in the first two, by E. R. Speyer and O. Orchard respectively, having already been noticed [*R.A.E.*, A, xvii, 186]. In

the third section an account is given by W. H. Read of numerous experiments with various chemicals to discover fumigants for its control in tomato houses. Ethyl p-nitrobenzoate, s-trichloroaniline and 2 : 4 dichloroaniline were only slightly injurious to plants when present in amounts sufficient to kill all the active stages of the mite, and further tests will therefore be made with these substances.

The Chalcid, *Encarsia formosa*, Gah., a parasite of *Trialeurodes vaporariorum*, Westw. [*R.A.E.*, A, xv, 240], was successfully bred throughout the winter by maintaining a temperature not lower than 58° F., thus enabling the Aleurodid to reproduce rather more quickly than the parasite. The emergence of the adult parasites from infested whitefly scales kept out-of-doors during the winter was very low, and more recent observations suggest that the Chalcids normally overwinter in the adult stage, outside the scale. Contrary to expectation, tobacco plants are unsuitable for breeding the parasite, as the adults do not settle readily on the foliage, and they have therefore become a valuable means of keeping a stock of whitefly comparatively free from parasitism. From March to October about 10,000 parasitised individuals were distributed to a dozen different localities on tomato foliage, and in only one case did the parasite fail to become established at the first attempt in glasshouses. The presence of parasitised whiteflies in nurseries up to 3 miles away from the Experiment Station, to which no distribution had been made, indicates that the adult is able to find its way into glasshouses and to travel considerable distances from nursery to nursery. On the other hand, the number of parasites that do so early in the year is considered insufficient to be the basis of complete control, and their breeding in a specially heated house is necessary so that large numbers can be distributed to nurseries early in the growing season. Although the parasite is apparently unaffected by hydrocyanic acid gas, naphthalene or nicotine, as used for fumigation, both the young and adult stages are liable to be destroyed by oil emulsions such as are used for the control of *T. telarius*, but since these emulsions also kill the whiteflies and their scales and the parasite is capable of re-invading houses from outside, this is not considered of importance.

The following recommendations are made for the control of *Diarthronomyia hypogaea*, Lw. (chrysanthemum midge) [*R.A.E.*, A, xvi, 10]. The plants should be sprayed with nicotine (90 per cent. commercial) at the rate of 1 part to 400 parts water, with potash soft soap at the rate of $\frac{1}{2}$ oz. to each gallon, to kill the adults as they emerge from the galls, and also the eggs. The spray is not effective against the larvae that have entered the leaf tissue and should be applied twice a week up to as short a time as possible before the flower buds open. All young growth from the base of the plant should be removed and burnt towards the end of December, in order to reduce the danger of infesting cuttings to a minimum and at the same time allowing the grower to obtain them by the end of January. All plant refuse in the houses should be cleaned up and burnt, together with all portions of the plant cut down after flowering and all old stools. All cuttings should be dipped in nicotine (1 : 800) without soft soap before planting. Petroleum emulsions had no effect in preventing the emergence of the midges from the galls.

The larvae of a Tortricid (possibly *Tortrix podana*, Scop.) and a Capsid, *Calocoris norvegicus*, Gmel., are recorded as damaging newly potted cucumber plants in greenhouses. The former first makes holes and later a fairly regular mine, usually on the upper surface of a leaf. The Capsid runs actively over the foliage and soil, puncturing the leaves, which

assume a mottled appearance and later become seriously deformed. Under normal greenhouse conditions there is little fear of its breeding. As the Tortricid larvae hibernate in the first larval instar under pieces of bark or wood and the Capsids live normally on a variety of weeds, there is little doubt that both pests were brought into the greenhouse on dirty staging.

Owing to the serious losses caused to grape vines by the larvae of *Tortrix podana*, electric lights over trays of water covered with paraffin were kept alight at night from the middle of April onwards through spring and summer, but as the proportion of female moths caught was small and the bunches of grapes showed no improvement in the autumn, these traps cannot be recommended. Females are attracted to jars containing beer, treacle and sodium fluoride, and a certain amount of control could be expected if about a dozen jars not less than 2½ ins. in diameter were used to each house of 100 ft. length. The most effective control is, however, obtained by spraying with 6 lb. lead arsenate paste and 2½ oz. saponin to 100 gals. water. Repeated applications are necessary for several weeks after the first foliage appears.

Erythroneura parvula, Boh. (greenhouse leafhopper) is a common pest of primulas and geraniums and is exceptionally injurious to mint. It causes little damage to chrysanthemums and has only once been recorded from cucumber foliage. In some cases it has been controlled by fumigation with tetrachlorethane, but this cannot be used in houses where chrysanthemums and certain varieties of *Pelargonium* are grown, as even the smallest quantity is injurious. Not more than 5 fl. oz. to 1,000 cu. ft., poured on the path of the greenhouse, is recommended where fuchsias, geraniums, salvia and heliotrope are grown. The largest quantity that can be used on any plant is 10 fl. oz. to 1,000 cu. ft.

TATTERSFIELD (F.), HOBSON (R. P.) & GIMINGHAM (C. T.). **Pyrethrin I and II. Their insecticidal Value and Estimation in Pyrethrum** (*Chrysanthemum cinerariaefolium*). **I.**—*J. Agric. Sci.*, xix, pt. 2, pp. 266–296, 1 fig., 4 diags., 3 tables, 12 refs. Cambridge, April 1929.

The following is taken from the authors' summary. Pyrethrin I and II have been isolated by the method of Staudinger and Ruzicka [*R.A.E.*, A, xiii, 298, 299] from pyrethrum (*Chrysanthemum cinerariaefolium*). Both are shown to be highly toxic to *Aphis rumicis*, L. The former was found to be the most toxic substance so far tested by the authors, and as it was about ten times as toxic to the insect as the latter, it is concluded that it is mainly responsible for the value of pyrethrum as a contact insecticide. Two micro-analytical methods of determining the pyrethrin content of pyrethrum are described. Comparisons of the pyrethrin contents, as estimated, with the results of direct toxicity experiments, both with the pyrethrum samples and the pure pyrethrins, confirm the validity of the analytical methods. There was a significant and positive correlation, in the samples tested, between the amounts of pyrethin I and II. Insufficient data are available to show a significant correlation between the size of flower-heads and the content of poison, or to draw conclusions as to the effect of external conditions such as soil, weather or age of the plants.

WARBURTON (C.). **Annual Report for 1928 of the Zoologist.**—*J. R. Agric. Soc. England*, lxxxix, pp. 316–322. London, 1928.

The principal insect pests that occurred in England during 1928 are briefly reviewed. Owing to the prolonged cold weather in spring, insects were slow in beginning their attacks, and although during the exceptionally fine summer and autumn many pests were observed, little serious damage was caused. In experiments, naphthalene distributed as a powder over young turnip plants seems to have been remarkably effective in preventing the oviposition of adult root maggots [*Phorbia brassicae*, Bch.]. A disease of willow, known on the Continent and attributed to the gall mite, *Eriophyes triradiatus*, Nal., was observed for the first time in England near Cambridge. Both leaf and flower buds were attacked and distorted, giving rise to abnormal growths in the form of "witches' brooms" similar to those on birch.

SARRA (R.). **L'Antonomo del mandorlo** (*Anthonomus ornatus* **Reiche) in provincia di Matera.** [The Almond Weevil in the Province of Matera.]—*Boll. Lab. Zool. Portici*, xxi, pp. 265–274. Portici, 25th January 1929.

Anthonomus ornatus, Reiche, is a pest of almond in southern Italy, where its bionomics are similar to those observed in Sicily [*R.A.E.*, A, xii, 343]. In February the egg stage averages 13–14 days. Pupation occurs in March and early April, and this stage averaged 14–15 days in captivity. The adults begin to aestivate at the end of June, reappearing in November. The flower-buds and leaves are the most damaged, the fruits being less severely attacked. The appearance of the injured parts is described very fully.

Three parasites have been observed, *viz.*, the Ichneumonid, *Pimpla pomorum*, Ratz., the Braconid, *Syrrhizus distinguendus*, sp. n., and the Chalcid, *Habrocytus fasciatus*, Thoms. *P. pomorum*, which is the most important, deposits an egg towards the posterior end of the larva of the weevil. The parasite larva feeds externally for 7 or 8 days and then leaves its host to pupate. The first pupae are seen early in April, and the adults appear later in the month. The larva of *S. distinguendus* is an endophagous parasite of the adult weevil. *H. fasciatus* oviposits on the larva of *A. ornatus*, and its larva is an ectophagous parasite.

Spraying with 5 lb. lead arsenate powder to 100 gals. water is suggested against the adult weevils on the foliage, but the principal measure is their collection by jarring the branches during the period of oviposition.

GRANDI (G.). **Le** *Hoplocampa* **dei Susini nell'Emilia. Nota preliminare.** [*Hoplocampa* on Plums in Emilia. Preliminary Note.]—*Ann. Tec. agrar.*, i, no. 1, pp. 59–62. Rome, 1st July 1928.

Plums in Italy are attacked by the sawflies, *Hoplocampa fulvicornis*, Panz. (*minuta*, Christ), *H. flava*, L., and *H. testudinea*, Kl., the adults of which appear towards the end of March. Mating occurs repeatedly, and in the intervals both sexes feed on the liquid in the calyx of the plum blossom. The newly hatched larva mines irregularly in the young fruit and does not always reach the kernel. Migration from one fruit to another may occur while the first fruit is still capable of affording food, and in some instances a larva returns to a fruit, making another

entrance hole. These migrations occur while the larvae are still only 1–2 mm. long and the fruits 2–4 mm. in diameter. The infested fruits do not always fall. The larvae enter the soil in May and eventually pupate and emerge as adults early in the following spring. Two or three applications of an arsenical spray (1 lb. lead arsenate, 2 lb. copper sulphate, 2 lb. slaked lime and 20 gals. water) should be made, beginning at the date when the petals fall. Cultivation of the ground beneath the trees in March will kill many pupae. All infested fruits should be collected and immediately destroyed.

[Silvestri (F.).] **Il R. Istituto Superiore Agrario in Portici—1872-1928.** —Large Imp. 8vo, 601 pp., 95 pls., 5 figs. Portici, 1928.

A detailed account is given of the foundation of this Institute and of its activities in the teaching of agricultural sciences, including economic zoology. Lists of the publications of the members of the staff are included.

Silvestri (F.). **Subsídio para o estudo dos Tortricidas dos Carvalhos (Burgo dos Montados) e seus Parasitas. I-II.** [A Contribution to the Study of the Tortricids attacking Oaks and of their Parasites. I–II.]—F'scap 4to, 50 pp., 40 figs. Oporto, 1927.

This is a translation of a paper already noticed [*R.A.E.*, A, xii, 12], with a preface by the translator, J. M. de Mira Galvão, giving a brief account of the serious injury caused in Portugal from 1915 to 1923 by *Tortrix viridana*, L.

Gaumont (L.). **Sur quelques Syrphides prédateurs d'Aphides observés aux environs de Montargis.**—*Rev. Path. vég. Ent. Agric.*, xvi, fasc. 2, pp. 62–64.. Paris, February 1929.

Among the Syrphids that commonly feed on Aphids in France, *Syrphus balteatus*, DeG., *S. vitripennis*, Mg., *S. corollae*, F., *S. auricollis*, Mg., *S.* (*Lasiophthicus*) *pyrastri*, L., *Sphaerophoria scripta*, L., *S. flavicauda*, Zett., and *S. menthastri*, L., have five or six generations a year. The flies, which first appear in March and April, suck the nectar from flowers and lay their eggs in colonies of various Aphids. The larvae reach maturity in about three weeks, after consuming large numbers of Aphids, and the pupal stage lasts about 10 days. Successive generations follow one another at intervals of about 40 days until the cold weather in November. Hibernation occurs as a torpid larva that is very resistant to low temperatures and widely varying moisture conditions. Other species of Syrphids, such as *Paragus quadrifasciatus*, Mg., and *Platychirus scutatus*, Mg., have only two or three generations a year and are less prolific. Adults of the former observed emerging at the beginning of August apparently represented the second generation. Each year a certain number of larvae of *Platychirus scutatus* were taken from colonies of *Brevicoryne* (*Aphis*) *brassicae*, L., and gave rise to adults in March or April of the following year. Other Syrphids are only observed during a short period of the year, generally during April ; these include *Melanostoma ambiguum*, Fall., larvae of which were taken during the first half of May 1927 from colonies of *Anuraphis padi*, L. (*helichrysi*,

Kalt.). These larvae spent the summer and winter in a state of suspended development, pupating at the beginning of March and emerging as adults at the end of the month.

Unfortunately these predacious Syrphids are attacked by various Hymenopterous parasites, sometimes as many as 90 per cent. of the larvae being parasitised. The number of Syrphids that attack Aphids is relatively small, but some species are sufficiently abundant to play an important part in controlling these pests.

GRASSÉ (P. P.). **Les insectes de la luzerne.**—*Prog. agric. vitic.*, xci, nos. 10 & 14, pp. 235–236, 335–340, 1 pl. Montpellier, 10th March & 7th April 1929.

The lucerne fields of the south of France are severely attacked by a number of insect pests, which are briefly dealt with, notes being given on their bionomics and distribution and the remedies used against them. *Hypera variabilis*, Hbst., which also attacks other cultivated crops, oviposits on lucerne in spring. The larvae hatch in a few days and feed on the tender parts of the plant for about two months, when pupation occurs on the plants, between the blades. The adults feed like the larvae until the hot weather comes, when they enter the ground below the plants and remain there until the following spring. A simple remedy is to take the crop in early so that only the hard parts of the plant remain, and sheep might be turned into the fields to devour any remaining leaves. A similar weevil, *H. nigrirostris*, F., is very widespread, but is seldom sufficiently numerous to become harmful; its life-history is practically the same as that of *H. variabilis*. The Chrysomelid, *Colaspidema atrum*, Ol., a somewhat similar pest, is dealt with at some length, most of the information being taken from an earlier source [*R.A.E.*, A, xiv, 116].

Minor pests include many weevils of the genus *Apion*, particularly *A. pisi*, F., and *A. trifolii*, L., but these attack only the flower buds and so are not injurious to the forage crop. *Subcoccinella vigintiquatuorpunctata*, L. (*Lasia globosa*, Schneid.), which requires about a month for development, attacks the leaves both in the larval and adult stages. The caterpillars of *Colias croceus*, Fourc. (*edusa*, F.), which has three generations a year in the south of France and two in the north, are sometimes important pests, feeding on the leaves and pupating on the stalks or under the leaves. The remedies are the same as for *C. atrum*. *Smynthurus viridis*, L., when very numerous, may do considerable damage to the tender leaves, and locusts also show a preference for lucerne fields.

HOFFMANN (A.). **Note sur les moeurs et les dégâts de** *Hypera arator* **L. (Col. Curculionidae).**—*Bull. Soc. ent. Fr.*, 1929, no. 4, pp. 47–52, 1 ref. Paris, 1929.

In 1926 a valuable planting of carnations was attacked by *Hypera arator*, L.; after several attempts this weevil was satisfactorily controlled, but suddenly reappeared in numbers during June 1927. The treatment was applied again, and appeared to be effective, but in a short time the plants were re-infested. It was then discovered that the leaves of *Stellaria media*, growing wild in the vicinity, were also infested, and these plants were probably acting as a source of infestation. Oviposition took place from the beginning of May until early October.

The larva is described in detail ; after feeding for 16–18 days, it spins a small cocoon on a leaf. The pupal stage lasts 12–14 days. The adult weevils arising from the last eggs laid hibernate just below the surface of the soil or beneath rubbish in dry places. The proportion of hibernating males is small, and it would appear that the females lay more eggs in the summer than in spring or autumn. It was noticed that the places kept damp by frequent waterings were most heavily infested. The injury is important, as the young leaves and young flower buds are preferred by the larvae. The primary bud being the first to appear is the first attacked, and as it produces the selected flower (the lower buds all being suppressed), its loss is a serious one. Faded flowers or even older buds are little attacked.

The spray formula that gave the most satisfactory results consisted of 2 lb. nicotine, 8 lb. soft soap, 0·3 gals. alcohol (90 per cent.) and 100 gals. soft water. The soap should be dissolved separately. The plants should be sprayed in the evening or in dull weather to avoid scorching the flowers. Two applications with an interval of 8–10 days are generally sufficient. Arsenicals cannot be used owing to the daily handling of the plants necessary in commercial plantings.

HUSTACHE (A.). **Un nouvel ennemi du cotonier (Col. Curculionidae).** —*Bull. Soc. ent. Fr.*, 1929, no. 4, pp. 52–53. Paris, 1929.

Amorphoidea rufa, sp. n., is described from Cambodia on cotton, to which it is injurious, and it has also been taken in Tonkin.

GAUTIER (C.) & BONNAMOUR (S.). **Remarques sur** *Ephedrus plagiator* **Nees (Hym. Braconidae); complément de description de cette espèce.**—*Bull. Soc. ent. Fr.*, 1929, no. 5, pp. 92–95, 1 fig. Paris, 1929.

A redescription is given of *Ephedrus plagiator*, Nees, which is a parasite of various Aphids. The author points out that the secretions or products of metabolism of the parasite have an effect on the colour of the mummified hosts, since Aphids on oats parasitised by *Aphidius* spp. are the colour of dead leaves, whereas Aphids of the same species collected at the same time from the same field but parasitised by *E. plagiator* were distinctly blackish.

NECHELES (H.). **Observations on the Causes of Night Activity in some Insects.**—*Chinese J. Physiol.*, i, no. 2, pp. 143–156, 1927. (Abstract in *Expt. Sta. Rec.*, lx, no. 3, pp. 247–248. Washington, D.C., February 1929.)

Investigations have shown that neither full sunlight nor light of different wave lengths exerts any direct influence on the activity of *Melolontha melolontha*, L. (*vulgaris*, F.) and other insects. Neither sunlight nor arc light produces in the air any gas that exerts a depressing influence on *M. melolontha*, and nitrous oxide has no effect. The only factor that has any appreciable effect on the activity of these insects is the humidity of the atmosphere (as influenced by temperature) and its effect on the rate at which water is lost by them. The hiding of insects during the day is attributed to the necessity for sheltering from the excessive evaporating power of day air (low humidity and high temperature), and their activity at night to a reversal of air conditions, night air being cooler and more humid.

Hoffmann (W. E.). **Notes on a Squash Bug of Economic Importance.** —*Lingnan Sci. J.*, v, no. 3, pp. 281–292, 2 pls., 2 refs. Canton [1928].

In the vicinity of Canton, the Coreid, *Acanthocoris scabrator*, F., all stages of which are described, is a serious pest of Cape gooseberry (*Physalis peruviana*) and two varieties of red pepper (*Capsicum*), and also at certain times of egg plant (*Solanum melongena*) and squash (*Cucurbita maxima*) ; it also feeds on various other solanaceous plants. Both nymphs and adults are gregarious, and all stages are often found on the same plant. They usually occur on the terminal branches and leaves, though the adults are sometimes found nearer the base of the plant. They usually feed on the lower surface of the leaves ; the nymphs may also feed on the blossoms. Hibernation takes place in the adult stage under stones, rubbish, etc., and the bugs may even crawl into the soil when it is sufficiently loose. The processes of mating and oviposition are described in detail. The eggs are laid in batches on the leaves, with an average of 12 in each. The incubation period depends on the temperature ; during May 1926 it lasted 11–14 days. Experiments indicate that while food is not essential to the newly hatched nymphs, a certain amount of moisture is necessary to enable them to moult. The nymphal stage lasts about 5–6 weeks. There are several generations a year with considerable overlapping, and in the vicinity of Canton there is a long breeding period. Spiders have been observed preying on the nymphs, and a small Hymenopterous parasite attacks the eggs and at times appears to produce almost 100 per cent. mortality.

As the adults and nymphs are gregarious and the adults do not take flight readily, they may quickly and easily be brushed into a tin of kerosene early in spring. Later the egg masses laid by the adults that escape should be collected and kept in containers to allow parasites to emerge. The parasites should be released in the field. Clean cultivation and the destruction of solanaceous weeds and self-sown Cape gooseberry plants are also recommended.

Pagden (H. T.). *Leptoglossus membranaceus* **F., a Pest of Cucurbitaceae.**—*Malayan Agric. J.*, xvi, no. 12, pp. 387–403, 2 pls., 27 refs. Kuala Lumpur, December 1928.

In Malaya, the Coreid, *Leptoglossus membranaceus*, F. (leaf-footed plant-bug), which is a widely distributed pest of cucurbitaceous plants and cotton, has only been observed in numbers in two localities. Both nymphs and adults have been taken on a variety of cucurbitaceous plants, and the adults have been recorded from oranges in a locality where the insect was found breeding on adjacent cucurbits. All stages of the insect are described in detail. The eggs, which are laid in rows, are found on the stems and fruit and hatch in 4–8 days. The life-cycle from egg to adult takes a little over a month, and the adults may live about nine weeks. They are extremely active, particularly in bright sunshine, but towards evening may be more readily caught with a hand net, a measure that is recommended. The nymphs may be destroyed with kerosene emulsion provided that they are actually wetted by it, but since they readily drop off the plants when disturbed, the method recommended where plants are grown on a framework or trained on sticks is to dislodge them by jarring the plants and catch them in pans of water containing kerosene. It is not advisable to grow cucurbits in the vicinity of *Citrus*.

Corbett (G. H.) & Miller (N. C. E.). **A List of Insects with their Parasites and Predators in Malaya.**—*Malayan Agric. J.*, xvi, no. 12, pp. 404–424. Kuala Lumpur, December 1928.

This list of the insect pests of Malaya, with their food-plants, parasites and predators, has been compiled from records obtained in the entomological laboratory since 1920, with a view to acquainting entomologists working in the Pacific area with the parasitic and predacious fauna of this region. A brief account is given of the introduction of the Tachinid, *Ptychomyia remota*, Ald., from Malaya into Fiji against *Levuana iridescens*, B.-B. [*R.A.E.*, A, xiv, 431]. It is pointed out that the method of confining pests in cages covered with gauze of sufficiently wide mesh to allow parasites to escape without their hosts could undoubtedly be used with success against several insects in Malaya, particularly *Setora nitens*, Wlk., which is an important pest of young coconut palms.

Menzel (R.). **De plagen van de thee in Nederlandsch-Indië (Java en Sumatra) en hare bestrijding. (Beknopt oversicht.)** [Tea Pests in Java and Sumatra and their Control. A concise Survey.]—*Arch. Theecult. Ned.-Ind.*, 1929, no. 1, 106 pp., 40 pls., 8 figs., numerous refs. Buitenzorg, February 1929. (With a Summary in English.)

This is a survey of the tea pests found in Java and Sumatra. A brief account of the biology and control of each species is followed by numerous references to the literature on it. The object of the publication is to summarise existing data and facilitate access to more detailed information.

Hussain (A.). **Entomology.**—*Rep. Dept. Agric. Punjab 1927–28*, pt. 1, pp. 26–31. Lahore, 1929.

Notes are given on a number of pests against which work was done during the year, many of which have been noticed from previous reports [*R.A.E.*, A, xvi, 419; xvii, 168]. In one locality as many as 91·7 per cent. of the fallen cotton bolls contained larvae of the spotted bollworm [*Earias*]. It was found that the stores of seed cotton and cotton seed are the main source of infestation of the crop by *Platyedra gossypiella*, Saund. (pink bollworm), and that ginning factories play an important part in carrying the infestation over from one season to the next. The most practical measure of control for these bollworms is the safe disposal of material infested from the previous year. All larvae of *P. gossypiella* in cotton seed were killed when the seed was heated to a temperature of 56° C. [132·8° F.] for 1¼ hrs., or when it was fumigated with carbon bisulphide at the rate of 1 oz. to 12 cu. ft. With reduced dosages of carbon bisulphide, the larvae appeared to be lifeless for a time but revived later.

Diaphorina citri, Kuw., which was of no economic importance in Lyallpur three years ago, is now reported to have made the profitable growing of *Citrus* impossible in that district. *Laphygma exigua*, Hb. (lucerne caterpillar) has been found to have as many as 10 generations between May and September. Examination of rice stubble showed that in the districts most heavily attacked by *Scirpophaga nivella*, F.,

and *Schoenobius bipunctifer*, Wlk., 60–99 per cent. of the stubble contained hibernating borers. After harvest all stubble should be burned or buried deeply. *Aulacophora abdominalis*, F. (red pumpkin beetle) caused particularly heavy losses to the melon crop, and the destruction of the beetles during the hibernating period is advocated. A simple method of preventing termites from attacking newly planted fruit trees is to line the pit dug to receive the plant with paper impregnated with Paris green. Experiments have shown that lac grows successfully on fig trees even at Lyallpur, and as the leaves of the fig give far more shade than those of ber [*Zizyphus jujuba*], attempts will be made to grow brood lac on fig trees to safeguard it against failure during the heat of the summer.

Muir (W. A.). **Epidemic Attacks by the Sal Heartwood Borer (*Hoplocerambyx spinicornis*, Newmn., fam. Cerambycidae) in the Forests of South Mandla Division, Northern Circle, Central Provinces, with special Reference to the Period 1924-25 to 1926-27.**—*Ind. For. Rec.*, xiii, pt. 5, pp. 145–219, 12 pls., 1 map. Calcutta, Govt. India Central Pubn. Br., 1929. Price *Rs.* 2.10 or 4*s.* 9*d.*

A detailed history is given of the severe epidemic attacks of *Hoplocerambyx spinicornis*, Newm., that occurred on sal (*Shorea robusta*) in one division of the Central Provinces during the period 1924–1927, with a view to constituting an accessible record for reference in the event of subsequent attacks and forming a basis for further research. A summary is also given of the available records of previous attacks, and various preventive measures are enumerated and discussed at length. The life-history data and most of the information incorporated in the report have already been noticed from other sources [*R.A.E.*, A, xv, 354–356]. Quotations from a paper already noticed concerning the trap-tree method of catching the adult beetles [xvii, 115] are given in an appendix.

Light (S. S.). **Report of the Entomologist [for 1928].**—*Bull. Tea Res. Inst. Ceylon*, no. 3, pp. 37–48. Kandy, 1929.

Several of the pests dealt with were recorded in the last report [*R.A.E.*, A, xvi, 687]. The egg-parasite of *Homona coffearia*, Nietn., has now been identified as *Trichogramma erosicornis*, Westw. Attempts to breed this parasite in eggs of *Sitotroga cerealella*, Ol., were unsatisfactory, perhaps because the eggs are too small, and it is suggested that *T. minutum*, Riley, should be imported to take its place. Nettle grubs, particularly *Natada nararia*, Moore, are developing a tendency to attack young tea even before tipping and also seem to be acquiring immunity from the effects of rain, so that their attacks are continued throughout prolonged wet periods. Very large numbers of the cocoons may be collected from the soil below the bushes and on the leaves. The application of Nitrolim to the soil was a failure, and this substance, calcium cyanide and sodium silicofluoride were all ineffective as dusts against the larvae. A Pentatomid bug is predacious on *N. nararia*. Bagworms, especially *Clania crameri*, Westw., were extremely numerous

on tea in some districts; prompt hand-picking prevented further damage. *Acanthopsyche subteralbata*, Hmps., spread from *Albizzia* to tea. *Prodenia litura*, F., caused considerable damage to tea immediately after pruning; eggs have been found on green manure loppings between the rows, and pupation occurs in the soil at the foot of the bush. Forking the soil for an inch or two, to expose the pupae, might prove profitable. Occasional outbreaks on tea were reported of *Stauropus alternus*, Moore (lobster moth), the caterpillars of which were collected by hand; *Notolophus posticus*, Wlk. (small tussock moth), which is really a pest of dadap (*Erythrina lithosperma*) but attacks tea after stripping, and for which collection of the cocoons is recommended; *Taragama dorsalis*, Wlk., which is also a pest of dadap and only attacks tea when in its near vicinity; and the weevil, *Astycus immunis*, Wlk. var. *bilineatus*, Mshl., which, migrating from dadap, injured only the older leaves of tea and therefore did little damage. Mites that were much in evidence on tea from August to October were *Tetranychus bioculatus*, W.M., *Eriophyes carinatus*, Green, and *Brevipalpus obovatus*, Donn. Shade over the bushes seems to be some protection from the last-named. *Helopeltis antonii*, Sign., has been present in Ceylon for many years, and though it has occasioned little trouble for a long time, it is showing increasing activity and causing considerable loss of crop in some places. The Fulgoroid, *Ricania speculum*, Wlk., attacked the older leaves of bushes that had recently been cut across; the bugs were present in all stages, chiefly on the lower surface of the leaves, eggs being laid in rows in the back of the midrib and side veins. *R. fenestrata*, F., also occurred in clusters on tea shoots. The Aphid, *Toxoptera aurantii*, Boy., is found in fields of tea recovering from pruning, but is largely controlled by natural enemies, particularly Syrphids. Minor pests of tea were *Zeuzera coffeae*, Nietn. (red borer), *Xyleborus fornicatus*, Eichh. (shot hole borer), and the termites, *Calotermes* spp. The grubs of *Anomala* spp. are sometimes very injurious to the roots of tea; forking cleared the soil of many of the grubs, but *Paspalum* in the vicinity was found to be badly infested and had to be destroyed. Applications of cattle manure are a frequent cause of the occurrence of these grubs. Experiments to determine the relative effects of certain insecticides with regard to the tainting of tea showed that lime-sulphur, flowers of sulphur, sodium silicofluoride (spray) and calcium cyanide produced very noticeable tainting; the effect of sodium silicofluoride as a dust was less definite, and kerosene-flour emulsion produced only slight tainting.

Among pests of shade trees in tea plantations the Geometrid, *Macaria pluviata*, F., caused considerable defoliation of *Albizzia*, the eggs being laid on the young shoots and the cocoons formed in the soil. Against *Pseudococcus* spp., which are the most important pests of *Tephrosia candida*, it is recommended to lop off and burn affected branches or the whole plant, though nothing can prevent re-infestation from *Gliricidia* and other plants. The Arctiid, *Argina syringa*, Koll., almost defoliated *Crotalaria longipes* in the field. The eggs are laid singly on the leaves, and pupation occurs in a loose cocoon, generally at the apex of the shoots. Paris green (1 lb. to 50 gals. water) or sodium silicofluoride mixed with 3 times its weight of sifted lime are successful remedies. The caterpillars of the Lasiocampid, *Trabala vishnu*, Lef. (which attacks tea in Indo-China) defoliate gum trees (*Eucalyptus robusta*). The eggs are probably laid on the stem of the tree, and the cocoons are suspended from a twig.

Tothill (J. D.). **A Reconnaissance Survey of Agricultural Conditions in the British Solomon Islands Protectorate.**—F'scap fol., 17 pp. Suva, Fiji, 1929.

The Hispid, *Brontispa froggatti*, Sharp, is said to have caused losses to coconuts in the Protectorate amounting to £65,000 in less than a decade. Only palms of less than 10 years old are attacked. The adult crawls to the base of the inner surface of unopened leaflets for oviposition, the eggs being laid singly or in a short chain and hatching in 3 or 4 days. There may be several dozen larvae in a single unopened leaflet, each one making a longitudinal scar in feeding. The larval stage requires 31 days. The greater susceptibility of certain palms was found to be due to a looseness of the leaflets in the unopened blades ; in particularly vigorous trees this condition does not seem to occur, but in cases of necessity, the adults will attack even the most tightly compressed leaflets. The general immunity of bearing palms from attack is apparently due to the rapidity with which leaves are put forth by them. In a healthy eight-year-old palm, putting out a new leaf each month, there is not sufficient time for the majority of the larvae to feed before the leaflets are unfurled ; hence such palms remain immune. A method of poisoning the larvae in the young fronds has been described [*R.A.E.*, A, xii, 299], though a nicotine and soap solution is advocated in the present case, but this method is expensive. Another that has given success on some estates is to cut out the central leaf of infested palms, though this operation needs close supervision, and to prevent re-infestation a large acreage must be treated every day. The larvae and adults after removal should be killed at once by holding the infested parts of the severed leaves over a flame. Tobacco and soap wash should also be applied to the cut surface of the tree. This method cannot be employed for very young palms, but those from 3 to 6 years old could probably stand the loss of one leaf about every six months. Artificial manures are useful in promoting vigorous growth. The question of biological control should be studied ; the predacious Clerid, *Callimerus arcufer*, Chpn., which occurs in Malaya and Java, might prove useful in this respect.

A frequent cause of nut-fall is the Pentatomid, *Axiagastus campbelli*, Dist., which is now considered to be the most serious pest of coconuts in the Protectorate, entailing losses amounting to at least £35,000 in a year. Clusters of eggs are laid at the bases of the leaflets, and the nymphs and adults feed on the newly opened inflorescences. The nymphal stages occupy about 36 days, of which 32 are spent in feeding, the injury being not so much in the punctures themselves as in the congestion of vascular tissue below the nuts made in the effort of the tree to heal the wounds. No satisfactory remedy is at present known. Outbreaks sufficient to produce total, or almost total, nut-fall are generally confined to a few acres and on these mechanical control might be advisable. Tobacco extract and soap, which also kills *B. froggatti*, might be applied with a small hand sprayer by natives climbing to the tops of the palms and spraying the youngest open spadices twice at an interval of about two weeks. If this spray is not strong enough, nicotine sulphate, kerosene emulsion or fish-oil soap could be tried. The ant, *Oecophylla smaragdina*, F., was present on many palms and destroyed large numbers of *A. campbelli*. *Iridomyrmex* sp., which was also present, never occurred on the same tree as *Oecophylla* and had no effect on the bug. In the western islands, where *Iridomyrmex* does not occur,

almost complete protection from the bug is given by *Oecophylla*. Attempts are being made to disseminate the latter among the palms by connecting the trunks with woody lianas [*cf. R.A.E.*, A, xiii, 227] or the bases by a chain of dead leaves, and by obtaining nests for colonisation. Two primary egg-parasites of *Axiagastus*, one of which is a small Chalcid that completes its life-cycle in 12 days, the other species requiring 16, probably exert considerable control, the degree of parasitism sometimes reaching 60 per cent.

COCKERELL (T. D. A.). **A new Mealybug infesting Coconut in the Solomon Islands.**—*Entomologist*, lxii, no. 791, pp. 90–91. London, April 1929.

Trionymus malaitensis, sp. n., is described from Malaita, British Solomon Islands. It is very injurious to coconut palms, occurring in great numbers on the fruit spathes and living in covered runways made by ants, one of which is a species of *Iridomyrmex*. Though this Coccid is provisionally referred to *Trionymus*, doubt is expressed as to the scope of this genus.

MUNGOMERY (R. W.). **Cane Pests and Diseases.**—*Queensland Agric. J.*, xxxi, pt. 3, pp. 203–204. Brisbane, 1st March 1929.

Crambus malacellus, Dup., was found damaging sugar-cane during December 1928. The larvae construct silken galleries by webbing particles of earth and débris together, and from this shelter eat right through into the central part of the shoot, causing "dead hearts." In the infested area young ratoons were damaged, shoots only 2 ins. high as well as larger ones from 12–18 ins. high being attacked. The injury usually takes place at ground level, but occasionally occurs either a little above or a little below this point. The damage was estimated at about 1 per cent. of the shoots in the field, but since all shoots in a field do not come to maturity, the real damage was probably considerably lower.

The larva, pupa and adult are briefly described. The larvae pupate in the soil in a silken web similar to the one already described. *C. malacellus* appears to be indigenous to Australia and probably feeds on grasses in addition to sugar-cane. It seems unlikely that this moth will ever be more than a minor pest of sugar-cane. It has been known to be present for some time, but it has never caused more than slight local damage, and although it occurs in other countries where sugar-cane is grown, it has never been reported as a pest of that crop.

VEITCH (R.). **The Potato Tuber Moth.**—*Queensland Agric. J.*, xxxi, pt. 3, pp. 206–207. Brisbane, 1st March 1929.

A somewhat popular account is given of the bionomics and control of *Phthorimaea operculella*, Zell. (potato tuber moth), which occurs throughout Australia and is generally considered the most important pest of potatoes.

Bishara (I.). **Preliminary Experiments with Dusting and Spraying against Insect Pests of Cotton.**—*Bull. Min. Agric. Egypt*, no. 77, 11 pp., 1 pl., 5 graphs. Cairo, 1928.

Sodium fluosilicate, which is cheaper and much less dangerous to animals than lead arsenate and which has also been found to be more efficient against *Ceratitis capitata*, Wied., in Egypt, was tried against *Platyedra* (*Gelechia*) *gossypiella*, Saund. (pink bollworm) and *Earias insulana*, Boisd. (spiny bollworm) in 1927. Cotton plants wet with dew were dusted with the insecticide, mixed with an equal volume of flour, on 11th and 23rd July and 9th August, samples of green bolls being examined every 10 or 12 days from 27th July, and a reduction of 53 per cent. in the infestation of the former species and of 66 per cent. in that of the latter was effected. Owing to its habit of crawling from one bud or young boll to another, the spiny bollworm is more likely to come into contact with the insecticide than the pink bollworm, which does not leave a bud or boll that it has entered until full fed. Observations of the habits of *P. gossypiella* in the laboratory suggest that the larvae usually crawl actively in search of a suitable bud or boll immediately after hatching, when the natural mortality is probably high. The plants were free from scorching and from aphis attack, which usually follows dusting with arsenicals. The cost of each treatment was about six shillings an acre, but this could be reduced by using a smaller quantity of a finer material.

In an experiment to test the value of castor-oil as a repellent, it was found that mineral oil, when used as a thinning agent, produced severe scorching of the plants. A 10 per cent. emulsion of castor-oil was prepared with resin, soft soap and water and applied to $\frac{1}{6}$ acre on 22nd August and again on 7th September, a gallon of oil being used each time and the green bolls examined at intervals. At the time of the first spray there were already 67 larvae to 100 bolls ; 16 days later the rate of increase in infestation was reduced by 42 per cent., and by 55 per cent. 11 days after the second treatment. By 28th September very little oil could be seen on the plants, and its effect had entirely disappeared. In another locality a solution containing 15–20 per cent. of oil was much more effective, as the thicker material adhered better.

Five acres of cotton were dusted with calcium arsenate and 5 with a dilute form of Paris green, 3 applications of each being given, and an average reduction of about 29 per cent. in the infestation of green bolls was produced. With the calcium arsenate the reduction in damaged seeds was about 30 per cent. in the first picking and about 15 per cent. in the second ; with the Paris green, however, there was no reduction in the first but one of 35 per cent. in the second picking. A bad attack of *Aphis gossypii*, Glov., occurred in September throughout the treated fields ; this would probably account for the yield from these being less than that from the surrounding untreated area, which did not become infested. In both series of experiments, the moths concerned were nearly all *P. gossypiella*, *Earias* being relatively scarce.

In the neighbourhood of Cairo, 7 broods of *Prodenia litura*, F., occur in the year, the most important being the third and fourth, the maximum flights of which take place about 20th June and 20th July. In Upper Egypt the spread of this moth is limited by the intense summer heat. The severity of its attack on cotton in Lower Egypt varies from year to year and in different localities. Clover was severely damaged in June and July 1927, and sodium fluosilicate was tested on the July brood. In the laboratory 100 per cent. mortality resulted both from a small feed

and from mere contact with the powder ; in the field, the dusted plots remained luxuriant, while the rest of the crop was completely destroyed. Vines were also badly attacked in another district, where the grapes were already ripening.

Carnation Worm.—*S. Afr. Gdng. Ctry. Life*, xix, no. 4, p. 116. Wynberg, Cape Province, April 1929.

Carnations in South Africa are attacked by the carnation worm [*Epichorista ionephela*, Meyr.], an indigenous moth, and the cotton bollworm [*Heliothis obsoleta*, F.]. The notes given on the bionomics of the former do not differ materially from those already noticed [*R.A.E.*, A, xiv, 232], and the control measures recommended are similar. Spraying infested plots with 1½ oz. lead arsenate in 4 gals. water reduced the infestation from 75 to 2 per cent. in two months, the plants being sprayed every 10 days in dry weather and after every heavy shower of rain.

H. obsoleta lays its eggs singly or in small groups on the flower buds. They hatch in 5–8 days, and the larvae burrow into the buds. It was found that a refined miscible oil (1 : 40) destroys the eggs.

Tanganyika Territory : Destruction of Locusts Ordinance, 1929. (No. 6 of 1929), 2 pp. ; **Regulations,** 2 pp. Dar es Salaam, April 1929.

The Ordinance prescribes the power of the Governor in Council to make regulations to provide for the destruction of locusts and to declare areas to which the regulations shall apply. Under the regulations, the owner or occupier of any land must at once report to an inspector the existence of egg-laying locusts, locust eggs, or locust hoppers, and must, on request, give all possible assistance in the steps taken for their destruction.

D'Emmerez de Charmoy (D.). [**Une nouvelle espèce de cochenille destructrice de la raquette,** *Opuntia tuna*.]—4 pp. [Mauritius, 1929.]

Several species of *Opuntia* have been present for some time in Mauritius, where they were probably introduced during the last century for the purpose of the cochineal industry, but since this product has been replaced by aniline dyes, their use as a food-plant for the cochineal insect has been abandoned and they have become mere pests. The most common varieties are *O. monacantha* and *O. tuna*. In view of the destruction of *Opuntia* in South Africa by *Dactylopius ceylonicus*, Green (*indicus*, Green), introduced from India by the Australian mission, the author undertook to introduce the same insect into Mauritius. As soon as the specificity of this Coccid for *O. monacantha* was understood, the work of destruction was rapid and within 15 years that plant was completely controlled in the Island. Attempts were then made to find a Coccid that would deal similarly with *O. tuna*, and after many experiments, *D. opuntiae*, Ckll. (*tomentosus*, auct.), which occurs in Ceylon on *O. dillenii*, was induced to feed on *O. tuna*, and in 14 months after its introduction had completely destroyed this plant over a surface of more than 32 acres. Observations on the life-history and methods of feeding of the Coccid are recorded, and the method of propagating it is explained.

Plants infested with newly hatched Coccids should be laid on some sort of support about 3 to 4 ft. high (in order to protect them from other insects and particularly spiders) in the open but sheltered from rain.

DA COSTA LIMA (A.). **Sobre o caruncho do café.** [On the Coffee-berry Borer.]—*Arch. Escola sup. Agric. Med. vet.*, ix, no. 1–2, pp. 3–49. Rio de Janeiro, December 1928.

This is a collection of the author's articles on *Stephanoderes hampei*, Ferr., published in Brazilian periodicals, the originals of which have already been noticed.

STAHL (C. F.). **Corn Stripe Disease in Cuba not identical with Sugar Cane Mosaic.**—*Bull. Trop. Plant Res. Foundation*, no. 7, 12 pp., 6 figs., 7 refs. Washington, D.C., 7th September 1927.

A conspicuous type of mosaic is commonly found on maize in Cuba, which, although resembling the mosaic disease of sugar-cane, is not identical with it and would be better designated by some other name, such as "corn stripe." The symptoms of both are described. Maize is susceptible to sugar-cane mosaic in Cuba, but the disease is rarely found, and infestation with *Aphis maidis*, Fitch (the vector) is not common. Corn stripe is transmitted by the maize leafhopper, *Peregrinus maidis*, Ashm.; attempts to transmit it by *A. maidis* or to inoculate it into sugar-cane were unsuccessful.

PLANK (H. K.). **A Summary of the Investigations of the Sugar Cane Moth Stalkborer in Cuba.**—*Bull. Trop. Plant Res. Foundation*, no. 8, 16 pp., 5 figs., 14 refs. Washington, D.C., 1929.

Diatraea saccharalis, F., is now the cause of greater damage to sugar-cane in Cuba than ever in the past, recent surveys showing injuries amounting to 13 per cent. or more of the total crop. The two most successful remedies elsewhere, namely, the cutting out of dead hearts and the use of poison dusts, have proved impracticable in the Island, and it is suggested that a detailed study of the natural enemies of the borer [*R.A.E.*, A, xiv, 542; xvii, 383] with a view to using them as controlling agents would be the most profitable line of investigation.

GRAHAM (S. A.). **Principles of Forest Entomology.**—Med. 8vo, xvi +339 pp., 1 pl., 149 figs. New York & London, McGraw-Hill Publishing Co. Ltd., 1929. Price 17*s.* 6*d.*

Although primarily a text-book, this volume should prove of interest to forest entomological workers, ecologists and those who grow or utilise forest products. The subject is dealt with through a consideration of general underlying principles, supplemented by a study of certain insects (where possible those occurring in North America) to illustrate the application of these principles in individual instances. The biotic potential and environmental resistance are discussed in this manner, as well as direct and indirect remedial measures. Examples of important insect pests that illustrate various ecological groups are treated in more or less detail. The comprehensive bibliography is classified according to chapters and contains references to numerous species that have not been discussed in the text.

Metzger (F. W.). **Information concerning Japanese Beetle Traps.**—*Circ. New Jersey Dept. Agric.*, no. 146, 8 pp., 5 figs. Trenton, N.J., May 1928.

The results of four years' work in devising an efficient trap for the Japanese beetle [*Popillia japonica*, Newm.] indicate that although the use of traps is an inexpensive means of capturing large numbers of adults, no protection is afforded thereby to fruit, flowers or foliage. Baits attract more beetles than would normally be present, and the traps hitherto used do not capture more than one-third of those attracted. From 1925 to the present time the average annual catch of each trap used in experimental work has been 50,000 beetles, and a daily catch of 10,000 beetles from a single trap is not uncommon. One type of trap in which large numbers of beetles were caught is described. It is constructed entirely of 28-gauge galvanised iron and is in the shape of a cylinder 12 ins. high and 7 ins. in diameter. The bottom is closed except for a very small hole to permit liquids to escape. A slightly wider funnel of tin or galvanised iron, 7½ ins. in depth, fits tightly over the top, the spout reaching just below the bottom of the bait container, which is rather less in diameter than the exterior of the trap, ⅞ in. in height, open at the top and covered with 16-mesh copper wire at the bottom. The side walls of the container are of the same material as the outer cylinder, and an opening 1½ ins. in diameter allows the lower end of the funnel to pass through the centre. The apparatus is suspended by means of a wire fastened to brackets on either side of the cylinder and extending 12 ins. over the top of it. The efficiency of the trap is increased by means of a "baffle" that obstructs the passage of beetles flying from 1 to 9 ins. from the top. These traps cost 8*s.* to 10*s.* each without bait, and last a number of years. The formula recommended for the bait is 1 teaspoon geraniol (at least 58 per cent. pure), 16 drops eugenol, 1½ cups bran, 1 tablespoon water, 2½ tablespoons molasses and 1½ teaspoons glycerine, the total weight being about 5½ oz., and the cost about 10*d.* for a single baiting of one trap or 2*d.* when the materials are purchased in quantity. Beetles should be removed from the traps after 7 p.m. or before 8 a.m., as they seldom fly between these hours and are less likely to escape. Each trap should be emptied at least every other day, and the cylinder should be kept free from any other odour except that of the bait. Though the traps are generally hung in the trees, nearly as many beetles are caught in traps suspended from posts 5–7 ft. high at a distance of 10–15 ft. from the trees, and an accumulation of beetles on the foliage is thus prevented. In the past three years, traps have been effective between 25th June and 1st September, but seasonal variation makes it impossible to fix definite dates.

White (H.), Fulton (B. B.) & Cranor (K. T.). **Clothes Moth Prevention as adapted to the Needs of the Housekeeper.**—*Ent. News*, xl, nos. 4–5, pp. 117–121, 137–141, 39 refs. Philadelphia, Pa., April & May 1929.

Experiments carried out with sodium silicofluoride, sodium fluoride and three proprietary moth-proofing compounds against the larvae of *Tineola biselliella*, Humm. (webbing clothes moth) are described. The results, which are rather inconclusive, indicate that these substances are of some value in protecting textiles from infestation. It was found, however, that a commercially moth-proofed blanket was as attractive

to larvae as untreated blanket samples of the same make. Experiments with various weaves of white woollen fabrics indicate that larvae prefer hairy, napped and loosely woven fabrics to tightly woven, hard-finished ones.

BROWN (J. R.). **An Enemy of the Corn Borer.**—*Canad. Field Nat.*, xliii, no. 5, p. 108. Ottawa, May 1929.

The downy woodpecker was observed in Ontario feeding on larvae of the corn borer [*Pyrausta nubilalis*, Hb.], which it pecks from the stalks of the maize.

BRITTAIN (W. H.). **Recent Advances in Insecticides.**—*20th Rep. Quebec Soc. Prot. Plants 1927–28*, pp. 11–16. Quebec, 1928.

This is a general survey of some of the most important recent developments in insecticides, most of which have been noticed in this *Review*.

BEAULNE (J.). **Insects injurious to Forest and Shade Trees and to Fruit Trees and Bushes. Buprestidae.**—*20th Rep. Quebec Soc. Prot. Plants 1927–28*, pp. 79–83. Quebec, 1928.

A very brief, general description of the habits of the Buprestids is given, the bulk of the paper comprising a partial list of the species known to be injurious in Canada, with their food-plants.

BEAULNE (J.). **The chief injurious Insects of Vegetables and Ornamental Plants in the Montreal District in 1927.**—*20th Rep. Quebec Soc. Prot. Plants 1927–28*, pp. 84–86. Quebec, 1928.

One of the worst vegetable pests in 1927 was *Phorbia* (*Hylemyia*) *brassicae*, Bch., which destroyed about 75 per cent. of the cabbages and cauliflowers in at least 90 per cent. of the commercial plantations near Montreal, the warm spring having proved favourable to its emergence. Ploughing in the autumn in order to bury the remains of the crop might greatly reduce the next year's infestation. Mercury bichloride gave very satisfactory results, and in this district should be applied while the plants are still in the seed-beds. *Hylemyia antiqua*, Mg., ruined about 90 per cent. of the onion plants. Deep ploughing in the autumn will destroy at least 75 per cent. of the fly. Baits of sodium arsenite and molasses should be put into earthenware receptacles when the soil is warm, as oxidation, which occurs in metal ones, destroys their effect.

HAZELHOFF (E. H.). **Methoden ter bepaling van topboorderaantasting en topboorderschade.** [Methods for the Estimation of Infestation and Injury by Sugar-cane Tip-borers.]—*Arch. Suikerind. Ned.-Ind.*, 1929, pp. 230–239. Soerabaia, 1929.

Methods are described for determining the infestation of sugar-cane by tip-borers [*Scirpophaga intacta*, Sn., and other species (*R.A.E.*, A, xvi, 377)] in the Dutch East Indies and the amount of injury caused.

Measures should be concentrated on *S. intacta*, which is the important species. Attention should be directed to the removal of the infested shoots, the collection of the moths and their eggs being of little value. Brief and intensive work at intervals of 3 weeks is preferable to prolonged but less intense action. A good result can be obtained with 3 or 4 rounds, beginning when the cane is 4 months old. In younger cane *S. intacta* is almost absent, the species present being of little importance as they seldom occur on older cane.

Hazelhoff (E. H.). **Biologische bestrijding van insectenplagen met behulp van inheemsche parasieten.** [The biological Control of Insect Pests with the Help of indigenous Parasites.]—*Hand. 5. Ned.-Ind. Natuurw. Congr. 1928*, pp. 437–444, 14 refs. Soerabaia, 1928.

The question of the importance of indigenous parasites in controlling pests is discussed, references to the literature being given [*R.A.E.*, A, xiii, 586, 587 ; xiv, 202 ; xv, 518, etc.], with special regard to the Dutch East Indies. The value of artificially encouraging a native parasite in certain special cases is mentioned [*cf.* A, xvii, 234].

Papers noticed by Title only.

[Bogdanov-Kat'kov (N. N.).] **Богданов-Катьков (Н. Н.) A Short Manual of Entomology.** [*In Russian.*]—Demy 8vo, 330 pp., 291 figs. Moscow, State Pubn., 1928. Price 4 *r.* 30 *kop.*

Takahashi (R.). **Life-history and Habits of** *Forficula auricularia*. [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xxxviii, no. 458, pp. 412–421, 1 fig. Tokyo, 1926. (Title in *Jap. J. Zool.*, ii, no. 2, p. (86). Tokyo, 31st March 1929.)

Teranishi (C.). **Wing Veins and their Variations in** *Tiphia* **(Scoliidae).** [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xl, no. 472, pp. 33–37, 2 figs. Tokyo, 1928. (Title in *Jap. J. Zool.*, ii, no. 2, p. (91). Tokyo, 31st March 1929.)

Sindi (O.). **Some Notes on the Reproduction of Plant Lice.** [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xl, no. 472, pp. 37–40. Tokyo, 1928. (Title in *Jap. J. Zool.*, ii, no. 2, p. (91). Tokyo 31st March 1929.)

Knowlton (G. F.). **A new Juniper Aphid** [*Minuticornis gravidus*, gen. et sp. n.] **from Utah with Notes on a few other Species.**—*Florida Ent.*, xii, no. 4, pp. 59–62, 1 fig. ; xiii, no. 1, pp. 4–8, 3 figs. Gainesville, Fla., December 1928 & March 1929.

Tissot (A. N.). **A new Dogwood Aphid** [*Pergandeidia corni*, sp. n.] **from Florida.**—*Florida Ent.*, xiii, no. 1, pp. 1–4, 1 fig. Gainesville, Fla., March 1929.

Priesner (H.). **Eine neue** *Mesothrips*-**Art aus Annam.** [*M. annamensis*, sp. n., on *Citrus* in Annam.]—*Boll. Lab. Zool. Portici*, xxi, pp. 215–217. Portici, 22nd January 1929.

Bellio (G.). **Ridescrizione del genere** *Tsukushiaspis* (**Hemiptera : Coccidae**) **dell'Estremo Oriente.**—*Boll. Lab. Zool. Portici*, xxi, pp. 302–309, 4 figs. Portici, 26th February 1929.

Bellio (G.). **Risultati zoologici della Missione inviata dalla R. Societá Geografica Italiana per l'esplorazione dell'oasi di Giarabub (1926-1927). Coccidae (Hemiptera).** [Re-description of *Targionia nigra*, Sign.]—*Ann. Mus. Stor. nat. Genova*, liii, pp. 187–194, 4 figs. Genoa, April 1929.

Box (H. E.). **Notas sobre la determinación científica del parásito díptero común de** *Diatraea saccharalis*, **Fabr., de las provincias del norte.** [Notes on the scientific Determination of the common Dipterous Parasite (*Paratheresia signifera*, Towns.) of *D. saccharalis* in the Provinces of North Argentina.]—*Rev. ind. agric. Tucumán*, xix, no. 5–6, pp. 132–133. Tucumán, 1928. [*Cf. R.A.E.*, A, xvii, 311.]

Ripper (W.). **Die Puppen der beiden Knospenwickler.** [Descriptions of the Pupae of the two Bud Moths, *Argyroploce* (*Olethreutes*) *variegana*, Hb., and *Eucosma* (*Tmetocera*) *ocellana*, Schiff.]—*Z. öst. EntVer.*, xiv, nos. 2–3, pp. 18–21, 25–28, 3 figs. Vienna, February–March 1929.

Parrott (P. J.). **Spray Practices with Reference to the Bud Moth** [*Eucosma ocellana*] **and Leaf Roller** [*Tortrix argyrospila*].—*Proc. New York St. Hort. Soc.*, lxxiv, pp. 27–39. Le Roy, N.Y., 1929. [*Cf. R.A.E.*, A, xvii, 269, 270.]

Daniel (D. M.). **The Oriental Peach Moth** [*Cydia molesta*] **in Western New York.**—*Proc. New York St. Hort. Soc.*, lxxiv, pp. 39–45. Le Roy, N.Y., 1929. [*Cf. R.A.E.*, A, xvii, 269.]

Seamans (H. L.). **Forecasting Outbreaks of the Pale Western Cutworm** [*Porosagrotis orthogonia*, **Morr.**] **and Army Cutworm** [*Chorizagrotis auxiliaris*, **Grote**] **in Alberta.**—*20th Rep. Quebec Soc. Prot. Plants 1927-28*, pp. 9–11. Quebec, 1928. [*Cf. R.A.E.*, A, xi, 363, 459; xvii, 97.]

Hutchings (C. B.). **An Enemy of the Lilac** [*Gracilaria syringella*].—*20th Rep. Quebec Soc. Prot. Plants 1927–28*, pp. 72–73. Quebec, 1928. [*Cf. R.A.E.*, A, xiii, 577.]

de la Barreda (L.). **Formulario de fungicidas, insecticidas y venenos más comunes que se usan para el combate de las plagas agrícolas.** [Formulae of the most common Fungicides, Insecticides and Poisons used against agricultural Pests.]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. México*, ii, no. 12, pp. 746–761, 1 fig. S. Jacinto, D.F., 1928.

Jourdain (F. C. R.). **British Finches : Their Economic Status.**—*J. Minist. Agric.*, xxxiv, no. 6, pp. 528–533 ; xxxv, no. 7, pp. 651–656 ; xxxvi, no. 1, pp. 52–57. London, September 1927, October 1928, & April 1929.

Speyer (E. R.). **The Red Spider Mite** [*Tetranychus telarius*].—*J. Minist. Agric.*, xxxvi, no. 1, pp. 58–64, 2 pls. London, April 1929. [*Cf. R.A.E.*, A, xvii, 186.]

BAKER (A. D.) & STEWART (K. E.). **The Onion Root-maggot (*Hylemyia antiqua* Meig.) on the Island of Montreal.**—*20th Rep. Quebec Soc. Prot. Plants 1927–28*, pp. 92–130, 2 pls., 37 refs. Quebec, 1928.

This extensive report on the bionomics and control of *Hylemyia antiqua*, Mg. (onion maggot) in Canada covers work carried out from 1924–1927, and some of the information has already been noticed [*R.A.E.*, A, xii, 535 ; xvii, 95].

Several species of fly have been recorded as feeding on the onion in Quebec, but *H. antiqua* is the most destructive and is apparently the only one that attacks healthy bulbs. All its stages are described. There are two complete generations in a year and a partial third. They overlap considerably, but the maximum oviposition occurs during June and August. Hibernation takes place in the pupal stage, and in Quebec the first flies emerge from the middle to the end of May, the maximum emergence occurring about the second week in June. The average pre-oviposition period is about 11–12 days, varying with climatic conditions. Injury is first detected about the middle of June by the drooping of the seedling onions, owing to the maggots of the first generation burrowing into the bulbs. Young plants usually die, and rot frequently results in older bulbs, there being apparently little difference in the relative resistance of different varieties.

Although sunlight and dryness are important factors in preventing the development of the egg, excessive moisture seems to have no detrimental effect. Under ordinary laboratory conditions the eggs hatched in 4–5 days. They are usually laid within an inch or so of the onion plant, and from experiments this appears to be the limit to which a newly hatched larva can migrate. Older larvae migrate considerable distances in search of a more suitable environment, showing a tendency to move away from the source of light. Thus one heavily infested plant may be the source of infestation of a number of plants in the immediate vicinity. The majority of the adults of the summer brood emerges from pupae in 14–16 days, the mortality being 6·5 per cent. The females of the overwintering generation usually select older plants for oviposition, so that in spring self-sown and trap plants are heavily infested, whereas seedlings are untouched. Those of the summer generation often select plants that have already been attacked or are diseased.

A historical review of the control measures used against *H. antiqua* is given. The poison bait method is based on the fact that there is a pre-oviposition period of some ten days during which the females feed before laying their eggs. The bait previously used with the greatest success consisted of $\frac{1}{4}$ oz. sodium arsenite and 1 pt. molasses in 1 gal. water [*R.A.E.*, A, x, 577], but it was found that the attractiveness of the molasses was diminished by the addition of the sodium arsenite, and extensive tests were therefore carried out with other substances. These were tested under field conditions, the flies being caught in traps raised two inches above the ground over petri dishes containing the baits. Molasses and water alone was always more attractive than any bait containing poison. Various oils and other organic compounds proved ineffective, but ferric chloride, sodium fluoride, sodium cyanide and mercury bichloride, used as substitutes for sodium arsenite in the formula already given, were tested over a long period and compared with the latter. The bait containing sodium cyanide proved far superior to the others in attractiveness, while mercury bichloride was considerably inferior. The addition of portions of the onion plant

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appeared to increase the attractiveness of the baits. Further experiments showed that the glucose in cane molasses is a perfect antidote for sodium cyanide, and a granulated sugar solution was therefore substituted for it. This, however, greatly reduced the attractiveness of the bait, so that molasses solutions containing sodium arsenite, ferric chloride or sodium fluoride gave the best results.

A list is given of the parasites and predators that have been recorded from *H. antiqua*, of which Staphylinid and Carabid beetles are thought to be the most important.

Bodenheimer (F. S.). **Contribution towards the Knowledge of Citrus Insects in Palestine. II.** *Dionconotus cruentatus* **Brullé, an important Insect Pest of Orange Blossoms in Palestine.**—*Palestine Citrograph*, i, no. 11–12, reprint 8 pp., 3 figs. Tel-Aviv, December 1928.

The Lygaeid, *Dionconotus cruentatus*, Brullé, which is found in the mountains but more especially in the coastal plain in Palestine, is particularly prevalent in a large number of orange groves in the Jafta district at the time when the orange trees begin to bloom. The adult and immature stages are very briefly described. The larvae hatch during January, and the adults appear in large numbers in the latter half of February, then become more rare and finally disappear towards the middle of March. In the mountains development is somewhat prolonged, and in Jerusalem insects were captured at the beginning of April. The life-cycle occupies 5–6 weeks. In the breeding cages the adults lived from 9 to 13 days, and the maximum number of eggs laid was 19. The eggs deposited in February and March do not hatch until some weeks after the beginning of the rainy season in January of the following year. Many plants are attacked, a list of some of which is given, but the only injury of great economic importance is caused to orange blossoms. The bug pierces the buds, which immediately dry up and fall. As many as 2,000 small unopened blossoms have been found on the ground in some cases, only 200–300 remaining on the trees, and although the attack is not usually so heavy, there is often a loss of half the flower buds. A second series of flower buds develops in place of the fallen blossoms, but these form late fruits of inferior quality with leathery skins.

In all heavily infested orchards weeds are abundant, particularly in low-lying areas that are marshy and hardly accessible from December to February. The bugs develop on the weeds, and the adults are much more attracted by orange blossom than any other available nourishment. The eradication of weeds during January proved a successful measure, but was expensive. Experiments were therefore carried out with a proprietary dust and flowers of sulphur, and dusting in the early morning during February against the larvae of *D. cruentatus* developing on weeds is recommended, the proprietary dust being preferred owing to its more rapid effect.

Miles (H. W.). **Tar-distillates for the Winter Spraying of Apples in North-west England.**—*J. Minist. Agric.*, xxxvi, no. 2, pp. 145–152. London, May 1929.

During 1928 field trials were carried out in Lancashire and Cheshire with five proprietary brands of tar distillate at strengths of 7½–8 per cent. and a spray fluid containing 0·25 per cent. di-nitro-ortho-cresol

as dormant sprays on apple trees against Aphids, Capsids, apple suckers [*Psylla mali*, Schmid.], Tortricids and the winter moth [*Cheimatobia brumata*, L.] and its allies. All the sprays gave satisfactory results, the percentage of control for the proprietary tar distillates for Aphids varying from 97·6 to 95·9, for *P. mali* from 96·7 to 87, for winter moth and its allies from 83·8 to 71·6, and for Tortricids from 90·8 to 81·6. The figures for di-nitro-ortho-cresol were 93·5 for Aphids, 93·4 for *P. mali* and 92·7 for Tortricids, but only 67·6 for winter moth, etc. The results with Capsids were inconclusive.

Falcoz (L.). **Un ennemi des cressonnières,** *Phaedon cochleariae* **F.**— *Bull. Soc. linn. Lyon*, viii, no. 3, pp. 17–18, 1 ref. Lyons, 8th February 1929.

Phaedon cochleariae, F., causes considerable damage to watercress in the neighbourhood of Lyons, some of the beds being entirely destroyed in the course of the summer. The adult beetles, after hibernating, appear in April, or earlier if the weather is warm, and feed on the leaves of the young plants. In May about 100 eggs are laid by each female in the parenchyma of the leaves. These hatch in 15–20 days, and the larvae, after feeding on the leaves for about 30 days, pupate in the soil. The adults appear 15–20 days later. The only practical control is to flood the beds frequently, as soon as the larvae become numerous, and thus wash them away, but as long as wild watercress beds exist, a permanent breeding-ground for the pest remains. It is partly kept in check by the Tachinid parasite, *Meigenia floralis*, Fall., and the predacious Histerid, *Saprinus virescens*, Payk., both of which attack the larvae.

van Poeteren (N.). **Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het Jaar 1927.** [Report on the Work of the Phytopathological Service in 1927.]— *Versl. Plantenziektenk. Dienst*, no. 55, 93 pp., 6 pls. Wageningen, March 1929.

Many of the pests here recorded in Holland were noticed in the two preceding reports [*R.A.E.*, A, xv, 107 ; xvi, 341]. Others include the Bibionid, *Dilophus vulgaris*, Mg., attacking oats ; *Cydia* (*Grapholitha*) *nebritana*, Tr., in pea pods ; *Nygmia phaeorrhoea*, Don., defoliating fruit trees ; the Capsid, *Lygus pabulinus*, L., on apple ; *Coleophora paripennella*, Zell., and *C. palliatella*, Znk., defoliating plums ; *Anuraphis tulipae*, Boy., on iris bulbs ; the sawfly, *Arge* (*Hylotoma*) *rosae*, L., which is sometimes very injurious to roses and is combated by the removal of the shoots in which the eggs have been laid ; *Stephanitis rhododendri*, Horv., on rhododendron ; *Malacosoma neustria*, L., on maple ; *Stilpnotia salicis*, L., on poplar ; and *Phyllodecta vitellinae*, L., and *P. vulgatissima*, L., on willow.

Müller (K.). **Bemerkungen zu den Reblausbefall an "Oberlin 595."** [Remarks on the Infestation by *Phylloxera* of Oberlin 595 Vines.] —*Weinbau u. Kellerw.*, 1927, no. 2, p. 9. (Abstract in *Neuheiten PflSchutzes*, Sonderheft Jahrg. 1928, p. 25. Vienna [1929].)

This variety of vine, regarded by Börner as immune from *Phylloxera*, has been recently largely used in Germany for stocks. No infestation on leaves or roots has been observed in various parts of Germany and Switzerland. In Alsace, however, severe leaf galls and some nodosities

have been found. These must be attributed to the southern race (*vitifolii*). That this race can spread in Germany is proved by its appearance in Saxony, where it was introduced with vines from Hungary.

VON LENGERKEN (H.). **Zur Lebensweise und zur Frage der Schadwirkung von** *Ptinus tectus* **Boield.** [On the Habits and the Question of the Harmfulness of *P. tectus*.]—*Mitt. Ges. Vorratsschutz*, v, no. 2, pp. 21–26, 2 figs., 17 refs. Berlin, March 1929.

The records of the occurrence in Europe of *Ptinus tectus*, Boield., which is an Australian species, are briefly reviewed, the first being that in 1901 in England. The author's observations were made in Berlin, where this Ptinid occurred in a heated basement where material originally intended as experimental poultry-foods was stored. At the end of October most of the cocoons were empty ; only a few contained pupae or newly-emerged adults. The choice of a place for pupation, which depended on the nature of the container, is discussed. In the case of material in a wooden box, many of the larvae bored into the wood in order to pupate, and the adults on emerging continued to bore through to the outside. Characters are given distinguishing *P. tectus* from *Niptus unicolor*, Piller, with which it might be confused.

BAUDYŠ (E.). **Hubení puklice švestkové** (*Lecanium corni*).—*Ceskoslov. Zemědělec*, x, no. 9, 1928, 3 pp., 2 figs. (Abstract in *Neuheiten PflSchutzes*, Sonderheft Jahrg. 1928, p. 36. Vienna [1929].)

Notes are given on the bionomics of *Lecanium corni*, Bch., which is a serious pest of plums in Czechoslovakia. When the leaves fall, a carbolineum spray (6–8 per cent.) should be applied, and the trunk and branches should be cleaned with straw dipped in a mixture of 10 per cent. kainit and formalin, or brushed with a 4 per cent. tobacco extract or with 3 per cent. soft soap.

NECHLEBA (A.). **Stärkeres Auftreten des** *Hylurgus glabratus* **Zett., im Karpathischen Waldgebirge.** [The Abundance of *Hylastes glabratus* in the Carpathian Forest Mountains.]—*Centralbl. ges. Forstwesen*, liv, pp. 133–138. Vienna, 1928. (Abstract in *Centralbl. Bakt.*, (2) lxxvii, no. 15–24, pp. 458–459. Jena, 25th March 1929.)

Owing to the conditions resulting from the war a very severe outbreak of bark-beetles occurred in the spruce forests in Czechoslovakia near the Polish frontier. This outbreak died out in 1921, but *Hylastes* (*Hylurgus*) *glabratus*, Zett., one of the species concerned, is permanently established in one district at altitudes of 2,500–4,500 feet. The eggs are laid in batches on the rough bark of spruces 70–80 years old, especially on the lower parts of the trunk. The egg stage lasts 2 weeks, the larval stage 5 and the pupal stage 2. Maturation feeding requires over a month. The females may oviposit more than once, so that small subsidiary broods may occur.

LOKSCHA (H.). **Die Schädigung des Weizens durch den Getreidelaufkäfer.** [The Injury to Wheat by *Zabrus tenebrioides*.]—*Landw. Fachpresse Tschechoslowakei*, vi, pp. 342–343, 2 figs., 1928. (Abstract in *Centralbl. Bakt.*, (2) lxxvii, no. 15–24, pp. 467–468. Jena, 25th March 1929.)

In parts of South Moravia the larvae of *Zabrus tenebrioides*, Goeze (*gibbus*, F.) did much damage to the leaves of young wheat in 1928, the

attack being more severe near meadows and places containing couch grass [*Agropyrum repens*], and on heavy, damp soil. The adults attack the grain. The eggs are laid in small batches about $\frac{1}{4}$ in. deep in the ground, and the larvae hatch in autumn and overwinter. The adults also sometimes hibernate. The measures recommended include crop rotation, and the isolation of uninfested fields by trenches, 1 ft. deep by 8 ins. wide, containing unslaked lime at the bottom, or by barriers of kainit strewn while the dew is still lying. Against adults on the edges of the fields, a spray of 1 gal. tobacco extract, 5 lb. soft soap and 24 gals. water is suggested.

[Grossheĭm (N. A.).] **Гроссгейм (Н. А.).** *Rhynchites bacchus*, **L.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 10, 143 pp., 70 figs., 112 refs. Mleev, 1928. (With a Summary in French.)

This is a detailed account of observations on *Rhynchites bacchus*, L., made in the Ukraine in 1924–27. This weevil has a two-year life-cycle, hibernating as a mature larva and again in the adult stage. All stages are described. In spring the adults infest a variety of stone-fruit trees, preferring plums, but also attacking apricots, bullace (*Prunus insititia*), blackthorn (*P. spinosa*), and cherries; at the period of ripening of the fruits they migrate to apple trees, and sometimes to pears. In autumn the new generation re-infests the stone-fruit trees. The young weevils concentrate on the crowns and feed on the contents of winter buds and the soft tissues of young shoots. They are very resistant to low temperatures and often do not begin to hibernate till November. Most of them hibernate on the surface of the soil, under fallen leaves, and some in the bark under moss. In the Kiev Government they emerge from hibernation about the middle of April and injure the buds, young shoots, leaves and flowers, and also attack the first green plums, causing them to dry and fall. They begin to pair by the middle of May, and from this time feed exclusively on the fruits, boring into them usually near the stem. The female oviposits in the fruit in a chamber that consists of two cells separated by a partition. Into one of these an egg is deposited, the second cell remaining empty; the opening is closed by the epidermis of the fruit and excreta. The second cell is made to dry up the fruit, and for the same purpose the female subsequently further injures the fruit and sometimes the stalk. Several eggs are laid in each fruit, and each female may lay as many as 230. The period of oviposition lasts from the end of May till about the middle of August; until the beginning of June, it occurs chiefly on plums, and then the beetles migrate to apple. Most of the adults die in July, and only a few individuals occur at the end of August. The eggs hatch in 5–9 days. The larvae mine in the pulp of the fruit; the infested fruits are often attacked by a fungus, *Monilia*, but do not always fall to the ground. After feeding for 20–33 days the larvae enter the soil for hibernation to a depth of $\frac{1}{2}$–12 ins.; some of them hibernate in infested fallen fruit. They usually remain in the soil for 12 or 14 months before pupating in July or August. The pupal stage lasts 10–13 days. The young beetles remain in the pupal chambers for about 10–40 days, and then make their way out to the surface and infest the trees.

The damage done by *R. bacchus* is most severe during the oviposition period, but is also serious during the period from the emergence of the new generation till hibernation, when 50 per cent. of the buds may be attacked.

The larvae of *R. bacchus* are destroyed by a fungus and by a bacterial disease, and the eggs by thrips. The parasites, *Pimpla calobata*, Grav., *Calyptus testaceipes*, Grese (sp. n.), and *Microbracon* (*Bracon*) *rhynchiti*, Grese (sp. n.), are described. Little is known of the bionomics of *P. calobata*; the larva lives in that of the host and leaves it only just before hibernation, which takes place in a thick cocoon, either in the galleries made by the host in the fruit, or in the empty egg chambers. In the spring the parasites pupate, and the young adults emerge. From the end of July till the end of September the larvae of *C. testaceipes* emerge from those of the host, chiefly after the latter have abandoned the fruit, and make cocoons in the soil. They reach the adult stage in the same autumn, but do not leave the cocoons till the following spring. The adults of *M. rhynchiti* occur in late May and early June. On leaving the host, the larvae spin cocoons in the fruit; hibernation probably occurs in larval stage. Of these three parasites *C. testaceipes* is the most important, the percentage of parasitism by the other two being insignificant.

In experiments on the control of this weevil, sprays of arsenicals or lime did not prove effective. Adhesive bands also proved useless, as the beetles begin to fly soon after emergence. Measures found to be effective include: shaking the beetles on sheets spread under the infested trees; digging and ploughing the soil in the orchards in late autumn to expose the larvae to cold; and trapping the beetles in the autumn in fallen leaves arranged in a ring at the bottom of the trees (nearly 100 per cent. of them were found hibernating under these leaves). Infested fruit, whether fallen or on the trees, should be collected. Trap bands made of straw, or wood shavings and paper, catch on the average not more than 30 per cent. of the beetles, when fixed at the bottom of the trunk; when they were attached higher, the percentage of the trapped beetles was still smaller. The bands should be fixed in the autumn, not ater than the middle of October, before the majority of the beetles enter the soil for hibernation.

The paper concludes with a key to the species of *Rhynchites* and *Byctiscus* that attack fruit trees, a key to the larvae of some species of *Rhynchites*, and third for the determination of the insects that injure the buds of fruit trees in spring according to the damage done.

[Krasnyuk (P. I.).] **Краснюк (П. И.)** *Aporia crataegi* **L.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 12, 44 pp., 38 figs., 174 refs. Mleev, 1928.

This is a detailed account of observations on *Aporia crataegi*, L., all stages of which are described, carried out in the Kiev Government in 1923–26. This Pierid is found in all parts of Russia. Outbreaks usually last 3–4 years and occur at intervals of 6 or 7 years.

In the Kiev Government the eggs are laid in June in batches of 50–140 on the leaves of fruit trees. A female lays 3 or 4 batches in 4 or 5 days. Apple is preferred, though pear, quince, cherry and other stone-fruits are also attacked. Most of the eggs are laid in the upper part of the tree in sunny places. They usually hatch in 16 days, and the larvae feed for about three weeks, after which they are ready for hibernation, which occurs in the third instar and begins in July. About the middle of April they resume feeding and pass through two more instars. After hatching, the larvae, which are gregarious, feed on the parenchyma of the leaves, covering them with a thin web. Though they do not eat

much before hibernating, the number of the leaves they skeletonise is sufficient to weaken the tree. They hibernate in the nests in thick cocoons, most of which contain only one larva. About 30 per cent. of the hibernating larvae die in the cocoons from an undetermined cause. In the spring the larvae feed on the buds, leaves and flowers, often entirely defoliating the trees. They spin nests between the terminal twigs, where they shelter during bad weather and at night. Under crowded conditions the development of the larvae is retarded if food is scarce; in search of it they may migrate to adjoining orchards and in 2 or 3 days cause severe damage.

Pupation usually occurs on the branches and trunks of the trees; the adults first appear at the end of May and are on the wing in June.

Of the predacious enemies of *A. crataegi*, the Pentatomid, *Auriga* (*Arma*) *custos*, F., is the most important, both immature and adult stages feeding on the eggs and larvae. Other Pentatomids, in the order of their importance, are *Pinthaeus sanguinipes*, F., and *Picromerus* sp., the adults of which feed on the larvae of *A. crataegi*. The larvae of *Adalia bipunctata*, L., and *Scymnus* (*Pullus*) *subvillosus*, Goeze, destroy the first instar larvae of *A. crataegi*; in insectaries adults reared from larvae of these Coccinellids continued to feed on the larvae and hibernated in the nests of the latter, where they destroyed the wintering cocoons. The larvae of *Chrysopa formosa*, Br., attack the eggs and younger larvae. At Mleev the following parasites were reared from the larvae and pupae of *A. crataegi*; *Pimpla brassicariae*, Poda, *P. instigator*, F., *Theronia atalantae*, Poda, *Apanteles glomeratus*, L., *A. spurius*, Wesm., *Brachymeria* (*Chalcis*) *minuta*, L., *Lydella nigripes*, Fall., *Phryxe vulgaris*, Fall., and *Blaesoxipha* sp. The percentage of parasitism was not less than 41 in 1924 and 67·6 in 1925. Many of the larvae are destroyed by flacherie, which killed 20 per cent. in 1925 and 80 per cent. in 1926.

Natural enemies, however, do not effect a marked decrease of the numbers of *Aporia* till the second or third year of an outbreak, and control measures are therefore essential. The removal and destruction of the hibernation nests is very effective and should be carried out from November till the end of February. The collection and destruction of the pupae, recommended by some authors, does more harm than good, as the parasites are thus destroyed also.

Spraying the trees in early spring before the buds burst killed only a small percentage of the larvae, which feed on the contents of the buds, where the poison does not penetrate. When the leaves were well developed, however, sprays of 1 lb. Paris green to 60 or 75 gals. water killed all the larvae on apple in four days, leaving the foliage undamaged. A 4 per cent. solution of barium chloride, mixed with molasses as an adhesive at the rate of 1 lb. to 12 gals. water, killed 90 per cent. The eggs were not affected by sprays of barium chloride (4 per cent.) or kerosene emulsion; insecticides are best applied soon after they hatch.

[Krasnyuk (P. I.).] **Краснюк (П. И.). Data for the Study of the Injury caused to Peas by** *Bruchus pisorum*, **L.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 18, 26 pp. Mleev, 1929.

This is a detailed account of work carried out in the Ukraine in 1924–26 to determine the resistance of various varieties of peas to infestation by *Bruchus pisorum*, L.

In peas sown at different times, the intensity of infestation depends on the time of flowering and on the meteorological conditions at that

period. The percentage of infestation was less when the peas were sown late, but the crop was so greatly reduced that late sowing cannot be adopted as a method of avoiding infestation. The varieties of peas, the period of the setting of which coincides with the intense oviposition of the beetles, are the most infested; plants that flower in the first half of June are therefore much more severely infested than those that flower earlier or later. If, however, the spring is late, all kinds of peas are equally infested. Some varieties are more resistant to infestation, but none is entirely immune. Meteorological conditions at the time of the flowering affect the oviposition of the Bruchid; it is retarded by low temperature and stopped by rainy weather. In 1925 the oviposition period lasted 59 days (from 27th May), and in 1926 it covered 64 days (starting on 26th May). The maximum number of eggs laid by one female in captivity was 92. Usually oviposition is very intense in the second half of June; the number of eggs decreases at the beginning of July, and by the end of that month oviposition stops.

[Pyatakova (V. L.).] **Пятакова (В. Л.). Flea-beetles.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 11, 75 pp., 70 figs., 203 refs. Mleev, 1928. (With a Summary in French.)

This is a study of the species of *Phyllotreta* occurring in the Kiev Government, with keys to the genera of Halticini and to the adults and larvae of the genus. A list is given of records in the literature of outbreaks of flea-beetles in Russia and elsewhere, with the popular names of the species of *Phyllotreta* used in Russia, France, England, Germany and Italy. In the Mleev district in 1923–25, *P. cruciferae*, Goeze, was the most numerous, others in order of abundance being *P. undulata*, Kutsch., *P. atra*, Payk., *P. nigripes*, F., *P. nemorum*, L., and *P. vittata*, F.

P. cruciferae occurs chiefly in the southern provinces of Russia. The life-history of the adults and larvae of this species and of *P. atra* are similar. Hibernation occurs in the adult stage. The first beetles appear usually in the middle of April, and are abundant at the end of that month or beginning of May. Both *P. cruciferae* and *P. atra* can live without food for about two weeks; they first attack the very young shoots of radish, turnip and mustard, but as soon as cabbage seedlings are planted in the fields, they infest these until the period of oviposition, when they migrate back to cruciferous root-crops, as these offer more suitable food for the larvae. Eggs are laid in batches of 20–36 in the earth near the food-plants. The duration of the egg stage varies considerably and depends on the temperature and humidity, also on the generation that produced the eggs, that of eggs laid by the second generation in July–August being the shortest. The larval stage lasts 2–3 weeks, the larvae chiefly feeding on very small lateral roots at a depth of about 4 in. in spring and summer, and 2–3 in. in autumn. Pupation occurs in the soil in pupal chambers; the manner in which the larvae build these is described. The prepupal stage lasts 3–9 days, and the pupal 6–13 days. The young adults remain in the pupal chambers 2–4 days, or longer in cold or dry weather. In the Kiev Government *P. cruciferae* and *P. atra* have three generations. The hibernating adults die out at the beginning of June, and the young adults of the first generation appear in the middle of that month. They first infest radishes, then migrate to cabbage; the damage caused by them to the latter is, however, not so severe as that by the early spring infestation, as the cabbage is then more advanced and consequently more resistant to attack. The feeding period and life-cycle of this

generation are also considerably shorter. About the middle of July, the beetles of the second generation appear, and those of the third are abundant by the end of August and beginning of September. These prefer young pods and flowers of cruciferous root-crops to cabbage, which is too coarse for them at that season.

The adults of *P. nigripes* appear very much later than those of other species, only occasional individuals occurring in spring. They increase considerably in August and September, when they chiefly infest turnip and partly radish, the larvae feeding on the roots.

P. undulata appears in the spring simultaneously with other species, its habits being similar to those of *P. cruciferae*, though the migration from cabbage seedlings to other cruciferous plants occurs a few days earlier, as does also the emergence of the young adults of the first generation. Eggs are laid in the soil near cultivated and wild cruciferous plants in batches of 10–36, oviposition being completed by the end of June or beginning of July. The egg stage lasts 3–10 days, and the larval about 18; the larvae live on small roots and do not penetrate deep into the soil. Pupation lasts 7–8 days, the young adults remaining in the pupal chambers 1–3 days.

P. vittata chiefly infests cabbage, radish and rape. The larvae feed on the finest rootlets, but sometimes also damage the tap root. The second generation appears in August. This pest is comparatively scarce in Russia.

The overwintered adults of *P. nemorum* appear about the middle of April. Eggs are laid either in small batches or singly on the underside of radish leaves and sometimes on the soil; oviposition lasts the whole summer till about the middle of September. The number of generations varies, from the northern districts only one has been recorded, whereas in the southern two, three, or even six may occur. The egg stage lasts 5–10 days and the larval 16–20, during which period the larvae moult four times; they mine in the leaves of radish. Pupation occurs in the soil, the pupal stage lasting 10–14 days. The young adults remain in pupal chambers 2–5 days before making their way out to the surface. This pest is commoner in the north than in the south of Russia.

Among the natural enemies of *Phyllotreta*, an unidentified Braconid of the subfamily EUPHORINAE infested in August 1924 as many as 43 per cent. of the adults. All stages of this parasite are described; its life-cycle lasts about one month. On abandoning the host, the Braconid larva spins a cocoon in cracks in the soil, and in 2–3 weeks the adults emerge. *Diospilus morosus*, Reinh., infests the larvae of *P. nemorum* while they are mining radish leaves and shortly before they enter the soil. The parasite larva develops in that of the host while the latter is in the prepupal stage and prevents it from pupating; on abandoning its host, the parasite spins a cocoon in the pupal chamber. In August the final development is completed in 8 days, while in September it takes 2–3 weeks. A species of *Eulophus* parasitises the partly grown larvae of *P. nemorum*; in 1924 the first larvae of this Chalcid were found at the beginning of August. The development of the parasite is completed in about two weeks.

The adults of *Phyllotreta* are also infested by Trombidiid larvae and by a Nematode. In 1924 about 40 per cent. of the larvae of *P. cruciferae* were infested by another Nematode, and 17 per cent. were killed by a fungous disease.

A list of popular control measures against flea-beetles is given.

[Grossheĭm (N. A.).] **Гроссгейм (Н. А.). Data for the Study of the Genus *Sitona*, Germ.** [*In Russian.*]—*Bull. Mleev Hort. Expt. Sta.*, no. 17, 57 pp., 66 figs. Mleev, 1928.

In this account of observations on *Sitona* spp. in the Kiev and Poltava Governments in 1915–17, the species dealt with are: *Sitona lineata*, L., *S. crinita*, Hbst., and *S. humeralis*, Steph., which are polyphagous species migrating from perennial leguminous plants to annual ones; *S. inops*, Gyll., *S. callosa*, Gyll., *S. hispidula*, F., and *S. sulcifrons*, Thnb., which are monophagous; and *S. flavescens*, Marsh., and *S. longula*, Gyll., which infest lucerne and clover. A list of the food-plants is given with notes on the distribution of the weevils on them at various periods. The economic importance of the genus is discussed. The chief damage is done by the adults, and the intensity of the infestation largely depends on the species and the age of the plant. Lucerne is more resistant to attacks in the spring than later in the summer. Clover and sainfoin suffer less on the average, as the species that particularly attack them do not increase to the same extent as those that breed on lucerne. Summer crops suffer more from the attacks of the weevils than the perennial ones. The larvae feed on the roots and root-nodules, as a result of which the latter lose their value as nitrogen-collecting organs and cease to raise the fertility of the soil.

The adults of *S. lineata* emerge from hibernation early in April and feed on the young leaves of lucerne and clover. Later in spring they migrate to summer crops but in autumn reinfest lucerne. Oviposition begins very soon after emergence, and the eggs are laid singly on the stems or leaves of the food-plant. The period of oviposition and the number of eggs that may be laid by a female vary and depend on the peculiarities of individuals and on the quality of the food; in insectaries it varied from 1 to 4 months. The maximum number of eggs laid by one female was 1,481 in 5 weeks, and the egg stage lasted 9–30 days. In nature the eggs remain on the plants only a few days; they then fall to the ground, where the majority of them sink into the upper layer of the soil owing to the action of dew and rain, or are blown into cracks by the wind. The young larvae are very active and begin to feed immediately after hatching, and a detailed account is given of the damage they do to the roots. The duration of the larval stage under favourable conditions in an insectary lasted 26 days. Pupation occurs in the soil; in 1916 pupae were found from the beginning of June till the end of July. The pupal stage lasts 8–11 days. The young adults remain in the pupal chamber for about 10 days and make their way out to the surface while their wings are still soft. Emergence of the adults occurs throughout June, July and August. They hibernate either on the ground under fallen leaves or in the upper layer of the soil.

S. crinita occurs together with *S. lineata*, its chief food-plant being either sainfoin or lucerne. The adults appear at the same time as those of *S. lineata* and infest the upper parts of the plants, whereas *S. lineata* concentrates on the lower parts. *S. crinita* also differs in preferring sunny, warm places. Oviposition occurs early in April, the maximum number of eggs laid in an insectary by one female being 277 in the course of $2\frac{1}{2}$ months. The egg stage lasted 7–29 days. The habits of the larvae are very similar to those of *S. lineata*. The young adults often attack wild perennial leguminous plants. This species may occur in such numbers as completely to destroy the summer crops.

S. humeralis var. *maculata*, Motsch., first attacks lucerne and then migrates to summer vetch and peas. It is less abundant than *S.*

lineata or *S. crinita*. Oviposition begins early in the spring, but is very irregular : while some of the females produce numerous eggs, others remain with still undeveloped ovaries. The egg stage lasts about 10–12 days, and the larval 29–40. Young adults occur in July.

S. inops exclusively attacks lucerne. The first adults appear in the middle of April and feed on the lower shoots. Oviposition lasts throughout April and May. The old adults die very soon after oviposition and disappear completely in July. In the insectary the egg stage lasted 8–36 days, the maximum number of eggs produced by one female in three months being 1,500. The habits of the larvae are similar to those of the preceding species. The damage caused by them to the roots and root-nodules of lucerne is discussed in detail. The majority of them have pupated by the end of July at a depth of about 12 in. The young adults of the new generation are abundant at the beginning of August. The feeding period lasts about two weeks, and in September the beetles enter the soil for hibernation at a depth of about 16 in.

S. callosa is a pest of sainfoin ; the weevils appear very early in the spring as soon as the snow has melted and chiefly occur on the soil under the food-plant. They oviposit twice; the first oviposition occurs in spring and gives rise to young adults in July and August, and these hibernate ; the second takes place in August and September, and results in larvae that probably hibernate also.

The adults of *S. hispidula* also emerge from hibernation very early in spring, and infest the overwintered leaves of cultivated and wild clover. Oviposition begins 5–7 days later on leaves near the soil. In insectaries the egg stage lasted 9–32 days, the maximum number of eggs laid by one female in 40 days being 332. The old adults die by the end of May, and those of the new generation appear in June. The majority of them enter hibernation in August and September, hiding in the soil or under fallen leaves.

S. sulcifrons attacks clover. In the years under review this weevil was not abundant ; oviposition was observed in autumn.

The adults of *S. flavescens* were found hibernating on lucerne, clover and sainfoin. Oviposition was observed chiefly on lucerne in spring, as well as in autumn, when more eggs were laid. Young adults occurred in July and August.

S. longula prefers lucerne, but also infests clover. This species does not occur in the spring, but numerous individuals were captured in the middle of July at the period of oviposition. Probably these weevils do not live long, as by the middle of September only single individuals occurred. They hibernate in the larval stage.

The damage done by the adults of *Sitona* spp. is to a certain extent checked by a fungus that kills 50 per cent. of them ; it infests beetles of all ages the whole year round. A small percentage of the larvae and pupae is also destroyed by a fungus, and a certain number of eggs are sucked dry by the larvae of *Aeolothrips fasciatus*, L. Experiments proved that the eggs of *Sitona* are also attacked by a parasite of the genus *Anaphes*. Adults of the latter emerged from eggs collected in the field and kept in the laboratory for over a month, and the females very soon began to infest the eggs of *Sitona*. From these infested eggs a new generation of *Anaphes* emerged in 25–30 days. The Braconid, *Pygostolus falcatus*, Nees, has been reared from the adults of *S. lineata*, *S. crinita*, *S. humeralis* and *S. inops* ; the eggs, which are laid in the adult of the host, and the larvae are described. Two generations of this parasite have been observed. After abandoning

the host, the larva of *P. falcatus* spins a cocoon either on the stem of the plant or on the soil near it, and pupates ; in May the pupal stage lasted 11–12 days. Other Braconid parasites are *Perilitus labilis*, Ruthe, and *Leiophron lituratus*, Hal. Their larvae pupate in cocoons on the soil, pupation lasting about 13 days. Under laboratory conditions a female of *P. labilis* infested 16 weevils in the course of 6 days. *L. lituratus* is the most active and is the commonest parasite of the adults.

To control these weevils perennial and annual leguminous crops should not be planted in close proximity ; after harvesting the summer crops, the stubble should be ploughed under in order to kill the pupae. Spraying with Paris green, 1 lb. to 120 gals. of water, or with a 4 per cent. solution of barium chloride, proved to be very effective and greatly reduced the numbers of *S. lineata*, *S. crinita* and *S. inops*.

[Il'inskiĭ (A. M.), Gitman (L. S.) & Maslennikov (I. P.).] **Ильинский (А. М.), Гитман (Л. С.) и Масленников (И. П.). Tables for the Determination of the chief Pests and Diseases of Orchards by the Type of Injuries caused.** [*In Russian.*]—8vo, 72 pp., 152 figs. Tula, Plant Prot. Sta., 1928. Price 70 *kop.*

These tables are intended for the use of fruit-tree growers in the Tula Government, and only the most common pests and diseases of considerable economic importance are dealt with, particulars being given of the preparation and use of the various insecticides recommended.

Woroniecka-Siemaszko (J.). *Agrotis ypsilon* **Rott. jako szkodnik roślin uprawnych w Polsce.** [*A. ipsilon*, Hufn., as an agricultural Pest in Poland.]—*Polskie Pismo ent.*, vii (1928), pp. 193–201, 9 refs. Lemberg, 1929. (With a Summary in English.)

An account is given of observations on *Agrotis ipsilon*, Hufn., carried out in 1928 in the Lublin Government, where this cutworm destroyed large fields of beet. Its geographical distribution and the existing literature on it are briefly reviewed. The damage caused to beet was first noticed in the second half of June. Badly infested plants withered and died. Later in the autumn the cutworms had also infested potatoes ; this had escaped observation during the summer as they fed exclusively on the tubers.

The larvae observed late in July were full-grown and approaching pupation ; those collected a fortnight later were in various stages of growth and included newly hatched individuals, which occurred on the underside of the leaves, while the more mature ones hid in the upper layer of the soil. Under laboratory conditions the emergence of the adults from the collected pupae lasted till the end of August, but in nature the moths were on the wing as late as September and the first week of October. At the end of October the larvae burrowed into the soil to a depth of about 6 in. or deeper, and constructed hibernacula, where they remained till next spring. It is probable that hibernation occurs also in the adult stage, the overwintering individuals being those that emerge in autumn.

Amicroplus (*Macrocentrus*) *collaris*, Spin., known to be a parasite of *Euxoa* (*A.*) *segetum*, Schiff., was bred from the larvae of *A. ipsilon*, but the number of individuals infested by this Braconid was insignificant. A fungus, *Entomophthora megasperma*, also infested the larvae.

Walton (C. L.), Jenkins (J. R. W.) & Thompson (H. W.). **Carbolineum Spray Trials in Wales.**—*Welsh J. Agric.*, iv, pp. 322–334, 2 refs. Cardiff, 1928. [Recd. May 1929.]

Trials were carried out in Wales during the winter of 1926–27 with various proprietary brands of tar-distillate winter washes on many kinds of orchard trees and bush fruits, including numerous varieties of apples. The results confirmed those obtained in previous experiments [*R.A.E.*, A, xiv, 400, 644; xv, 516], and little difference was noticed in the efficacy of the individual sprays.

Jenkins (J. R. W.). **Seed Treatment as a Means of preventing Turnip Flea Beetle Attack.**—*Welsh J. Agric.*, iv, pp. 334–342. Cardiff, 1928. [Recd. May 1929.]

Damage by turnip flea-beetles [*Phyllotreta*] is most serious when the young plants are breaking through the ground or when they are still in the seed-leaf stage, an attack after the rough leaves appear being comparatively harmless. One of the methods of preventing attack on the seed-leaves is the treatment of the seeds before drilling with paraffin or turpentine, but since opinions on the efficacy of this treatment vary, experiments were undertaken to obtain conclusive evidence on the matter. It was assumed that under certain conditions the treatment was successful, and that the deterrent effect in these cases was due to the seed-leaves carrying up with them sufficient paraffin or turpentine odour to make them objectionable to the beetle. Both laboratory and field experiments were carried out with various types of swedes and turnips. The method adopted for treating the seed was, in most cases, that usually employed by farmers who include seed dressing as part of their normal practice. This consists in spreading the seed out on a bag, sprinkling it with paraffin or turpentine and then rubbing it with the palm of the hand until every seed has received a coating of the liquid. The seeds should be thoroughly wetted, about a teacupful of paraffin or rather less of turpentine to one pound of seed being necessary to accomplish this. The seed is then left on the bag to dry, and sowing should not be attempted until the seed is properly dry or the drill will tend to clog.

The treatment had no ill effect on the energy or total percentage germination, even when germination was delayed up to 17 days after treatment, and it is very unlikely that the use of excessive quantities of paraffin or turpentine would prove harmful. Treated seed in almost every case possessed slightly higher germinating powers than untreated seed, probably owing to a slight sterilising effect exercised by the liquids used. Field experiments showed that under favourable conditions the treatment appreciably reduces infestation by the flea-beetle. The conditions necessary for the success of this method appear to be that sufficient liquid should be used to make the seed thoroughly wet, that drilling should take place as soon as possible after treatment, and that germination should not be delayed. Soaking the seed for half an hour does not neutralise the ill effect of prolonging the period between treatment and drilling, and would probably fail to neutralise the ill effect of delayed germination. Under favourable conditions, however, a high degree of control may be obtained, and the labour and expense entailed are negligible.

In a note the author points out that certain commercial turpentines have been reported to have a deleterious effect on germination, and therefore suggests that if turpentine is to be used it should first be tested by treating a small quantity of seed with it.

THOMPSON (H. W.). **Further Tests of Poison Baits in South Wales.**—*Welsh J. Agric.*, iv, pp. 342–347, 3 refs. Cardiff, 1928. [Recd. May 1929.]

Owing to the danger of using arsenicals, further tests were made with bran baits against Tipulid larvae [*R.A.E.*, A, xiv, 402] to find a suitable substitute for Paris green. Anhydrous copper sulphate at the rate of ½ lb. to 10 lb. bran was not effective, whereas derris powder at the same rate showed a definite insecticidal value, though it was not so effective as Paris green. It had been intended to test sodium fluosilicate under the same conditions, but no suitable opportunity occurred during 1927. Promising results were, however, obtained with this bait against cutworms.

WALTON (C. L.). **Some Experiments for the Control of Mangold Fly.**—*Welsh J. Agric.*, iv, pp. 347–350. Cardiff, 1928. [Recd. May 1929.]

During the past few years, more or less severe infestations of mangels (particularly in the seedling stages) by larvae of *Pegomyia hyoscyami* var. *betae*, Curt. (mangel fly) have been general in North Wales. In preliminary experiments, dusting with 2 per cent. green tar oil or nicotine sulphate and spraying with Bordeaux mixture were ineffective in preventing attacks. Sprays of oil emulsion (1 pt. paraffin and 1 lb. soft soap to 10 gals. water) or nicotine sulphate (2½ oz. nicotine sulphate and 1 lb. soft soap to 10 gals. water) did not injure seedling plants and afforded considerable protection, but should be applied as soon as the plants appear. Rolling would seem to be a reasonable and effective method of control, and if done before thinning, does not harm the plants. In one experiment, the rolled area yielded two living larvae in 100 mined leaves, while on the unrolled area larvae were present in almost every mined leaf examined.

JENKINS (J. R. W.). **Observations on the Control of Weevils of the Genus *Apion* attacking Red Clover.**—*Welsh J. Agric.*, v, pp. 176–186, 4 refs. Cardiff, 1929.

Apion apricans, Hbst., *A. assimile*, Kby., and *A. trifolii*, L., attack red clover in Wales; the adults feed on the foliage and the larvae on the young ovules, thus seriously affecting crops grown for seed production. The immature adults emerge from hibernation during the last half of April and feed on clover foliage. This feeding is usually unimportant, but if the young growth is already retarded by climatic conditions, the partial defoliation caused by the adult weevils results in a further check. Oviposition begins about the middle of May, the eggs being laid singly in the green flower-heads before the individual florets have opened. The commencement and duration of the oviposition period, which may last 5 or 6 weeks, are closely related to conditions of wind and temperature. The length of the egg stage is also dependent on these conditions and varies from 4 to 6 days. The larval period

averages 18 days, during which time 7–10 ovules are consumed. The larvae are very sensitive to conditions of humidity and are killed by the desiccation of the flower-heads that occurs during hay-making. The pupal stage usually lasts about 6 days, but under conditions of low humidity it may last 10–12, though there is no evidence to show that desiccation is fatal to the pupae. There are two generations a year, but owing to the extended period of oviposition, considerable overlapping occurs.

With an early-flowering non-persistent variety of clover, the first cut is taken for hay and the second cut for seed. A late-flowering persistent variety is usually cut for hay about the middle of July and the aftermath grazed; in the second year it is either grazed until the end of May or cut for hay about that date and is then left to grow for seed, which is harvested towards the end of September. Since there must be a stage in the flower-head development of the crop when the majority of the weevils are in the egg or larval stage and are, therefore, liable to desiccation, a hay crop taken at this time would result in the maximum amount of weevil mortality. With a non-persistent variety, this hay cut would necessarily have to be made in the seed harvest year. With a persistent variety, however, the hay cut in the seed harvest year is made at the end of May, at which time the production of flower-heads would not have begun even if the crop had not been grazed, and the hay cut for weevil control would have to be made in the first year. Experiments were, therefore, undertaken with a persistent variety of clover to determine what effect the time of hay cutting would have on weevil destruction and on the total yield and aftermath.

Clover and grasses were sown on 16th June, and part was cut on 16th July when the majority of the flower-heads on the main stems had only just formed, part on 20th July when the clover was in nearly full flower, and part on 6th August when the clover was in the early seeding stage and 75 per cent. of the flower-heads on the main stems were brown. Counts made of the weevil population showed that the first cut was too early since egg-laying was not complete, and the second cut, made when 50-70 per cent. of the clover was in bloom, was too late, since, although oviposition was completed, many of the weevils had reached the pupal stage and were able to survive desiccation. The optimum time would appear to be between the first and second cuts, possibly when about 25 per cent. of the flowers were in full bloom. Observations showed that varying the time of hay cutting within the limits of the experiment had a negligible effect on the total yield.

A further experiment was carried out in the following year to test the theory derived from the first experiment, and flower-heads were picked on 7th July when the flowers were in the early bud stage, on 15th July when 25 per cent. of the heads were in full flower, and on 23rd July when 70 per cent. of the heads were in full bloom. Examination showed that the *Apion* population in the heads taken on 15th July was more than double that of the heads picked on 7th July, and the percentage killed was only slightly less than that in the early bud stage. It is improbable, owing to the many controlling factors, that the optimum time for cutting the hay to ensure the maximum larval mortality can be defined exactly, but it is evident that if the cut is made when 25 per cent. of the crop is in full flower, the mortality is very high. In fields of clover not kept for seed and never cut for hay, grazing is often incomplete, with the result that the plants produce large

numbers of heads and are in flower most of the year. Such a condition is favourable for weevil increase, and mowing such a field when 25 per cent. of the flowers are in full bloom is therefore recommended. A similar procedure is advisable when a favourable season causes considerable head production in the aftermath. Clover heads taken from hay at different times before it was carted showed numbers of dead larvae and living pupae but no living larvae and only occasional dead pupae. Heads taken from a rick about a month after it was made yielded numerous dead larvae but no pupae. These observations show that haymaking under ordinary conditions kills the larvae but neither haymaking nor stack conditions result in pupal mortality.

Heads were collected on 25 farms in seed-producing areas just before the crops were harvested to determine to what extent a persistent variety of red clover was injured by the attacks of *Apion* spp. The weevils present were almost entirely *A. trifolii*, and practically the total population was in the pupal stage and would thus be able to survive desiccation. It was estimated that the monetary loss caused by these weevils was about 25*s.* per acre.

Munro (J. W.). **The Biology and Control of** *Hylobius abietis*, **L.**—*Forestry*, ii, no. 1, pp. 31–39 ; iii, no. 1, pp. 61–65, 3 refs. London, 1928–29.

Hylobius abietis, L., the only species of the genus occurring in Britain, was relatively rare in England until 30 years ago, but is now widely distributed both there and in Ireland, chiefly owing to the transport of timber. The most important features in the biology of this weevil are its long life in the adult state, in which it feeds and is injurious, the production by the female of several broods over a period of 3 or even 4 years, and the consequent variation in the life-cycle from egg to mature adult, dependent on the date of egg-laying. Eggs laid in early summer result in rapid development, whereas eggs laid in autumn develop slowly.

The weevil hibernates in the upper layers of the soil, temperature being the chief factor governing its entry into, or emergence from, hibernation. In cold winters in the north of Scotland *H. abietis* remains inactive from October till April, but in the south of England it becomes active during the milder weather that sometimes occurs in late January or early February. Experiments in control cages indicated that weevils become active when the temperature reaches 49–50° F. Oviposition began on 11th April with an outdoor temperature of 58° F. and continued until 28th May. Trapping records on felled areas in widely different localities show a slow and gradual rise in numbers during May, an abrupt rise during June in England and during June and July in Scotland, and finally a gradual decline until September and October, when no weevils are found. Observations indicate that the first weevils that appear in spring are old adults that have spent one or more summers in the open, and these are joined later by weevils just emerged from the pupal beds where they have overwintered as adults or, more rarely, as pupae. Activity and feeding follow emergence from hibernation, the weevils feeding on the young bark and cambium of any woody plant, but showing a preference for conifers. Fallen tops and branches lying on the soil, leaders and side branches of young larch and spruce trees 15–20 ft. high, and the tops of pines 40–50 ft. high are particularly attacked. The main natural food-

plant of *H. abietis* is the Scots pine [*Pinus sylvestris*], in which it causes a malformation of the crown corresponding to that caused by the bark-beetle (*Myelophilus*). The weevil bores into the cambium, undermining the outer bark, which it levers off with its snout. The injury is compared with that caused by *Pissodes* and the pine sawflies, *Diprion* (*Lophyrus*) *pini*, L., and *D.* (*L.*) *sertifer*, Frcr. (*rufus*, Kl.). For the purpose of oviposition, *H. abietis* chooses stumps or roots below soil level or branches and stems closely pressed to the soil, moist conditions being essential to successful egg-laying. In an experiment begun in 1922 in which several males were painted and released to determine to what extent they wandered from their breeding ground, one was taken in 1924, two years after release, and the maximum distance traversed by the weevils, as shown by trapping records, was 800 yards. Pine billets proved very effective traps if embedded in the soil, male weevils being attracted to them to the same extent as females. Ditches and drains, burned or rough overgrown heather, sandy tracks and roads offered no obstacle to the weevils. Most of those recovered were taken west of the point of release. A definite movement took place between a felled area, which did not attract all the weevils in its vicinity, and standing woods and *vice versa*. Branches broken off by snow in a pine belt west of the felled area and lodged in the ground harboured both larvae and adults, including marked individuals. In moving from the felled area to standing timber, the weevils wandered in a direction contrary to the prevailing wind, which was westerly. Burning or charring the stumps proved no deterrent to *H. abietis*, and charred stumps were in some cases preferred for oviposition. Observations made during field work in many parts of the country, combined with records of experimental control work, show that outbreaks of *H. abietis* arise from the presence of a few weevils in standing woods in proximity to a felled area and in the felled area itself, which rapidly increase in numbers as soon as felling takes place.

The effect of climate on outbreaks of *Hylobius* is unimportant in Britain. While the warmer climate of the south of England directly increases the rates of development and reproduction, its indirect effect in drying up the soil, stumps and roots tends to cancel the direct effects. Similarly, whereas the milder climate of the west of Scotland does not retard the development of the weevil as do the frost and cold winds of the east, the rate of decay of the stumps and roots is more rapid there. Soil conditions, which affect *Hylobius* mainly indirectly, are an important factor regulating the distribution and growth of *Pinus sylvestris*, and affect the period during which the stumps and roots are habitable by the weevil.

The only effective natural enemies of *H. abietis* are parasitic insects, of which the most important in Britain is a Braconid closely allied to *Microbracon* (*Bracon*) *hylobii*, Ratz. This Braconid lives as an ecto-parasite on the larva and under natural conditions will destroy 30 per cent. of its host. Another parasite is the Ichneumonid, *Ephialtes tuberculatus*, Fourcr., which only occurs rarely. The insects and other animals associated with *H. abietis* are discussed, but none of them appears to be of more than minor importance in regulating the abundance of the weevil, which is mainly controlled by the food supply both in the adult and larval stage.

H. abietis is dependent for its breeding ground on trees reduced to an almost pathological condition resulting from drought, fungus attack, or injury, and the abundance of the weevil in standing wood is

regulated by the number and size of trees in that peculiar condition available in the area. If fungus reservoirs, as suggested by Buchner [*R.A.E.*, A, xvi, 213], occur in *H. abietis*, it is almost certain that this weevil requires, for the successful establishment of its broods, conditions in the tree or its roots that are favourable to the development of the fungal symbiont, the existence of which is implied by the presence of such reservoirs. This would account for the slightness of the variation taking place from year to year in the numbers of *Hylobius* in standing woods, and the enormous increase that follows felling, which provides suitable breeding ground. Most of the control measures at present in use against *Hylobius* aim at reducing the breeding ground by the removal of stumps, or by charring them or treating them with creosote; or at trapping the weevils in the felled area itself. The best time to control the weevils, however, is to destroy them in the standing woods 2 or 3 years previous to the felling of the trees, before they have become numerous and when traps consisting of short sections of pine stem or branch partly submerged in the soil are particularly attractive.

Scott (H.). **An Entomological Tour in Kurdistan.**—*Ent. Mon. Mag.*, lxv, pp. 69–82, 3 pls., 1 map. London, March 1929.

Notes are given on the pests observed in the course of a tour in the mountainous country of Kurdistan, Iraq, during June 1928. Beet foliage was seriously damaged by flea-beetles, the most numerous species being *Phyllotreta cruciferae*, Goeze, and *Chaetocnema tibialis*, Illiger; a third species, probably *Haltica tamaricis*, Schr., seemed to be much scarcer. Wheat in places had been left unharvested as worthless owing to the depredations of the Pentatomid, *Eurygaster integriceps*, Put., one of the worst pests in Iraq, Syria and parts of Persia and Russia. This bug occurs in Iraq from the northern and eastern frontier hills to the plains as far south as Baghdad. South of that latitude, cereals are harvested before the nymphs reach maturity, and the consequent enormous mortality prevents the damage from assuming serious dimensions. The adults appear on the young crops in early spring, probably migrating from the hills, and lay their eggs in late March and April [*cf. R.A.E.*, A, xiii, 71; xvii, 290]. Both adults and nymphs feed first on the stems and then on the grain, the attack on the stem producing tillering and that on the ears rendering the grain valueless. By the latter part of May most of the nymphs have become adult. Some of the adults, but apparently only a small proportion, aestivate in the plains, having been found near Baghdad early in June under dry clods at the roots of fig trees or several inches deep in the soil. Adults reared in captivity evince a marked desire to take flight when a few days old, and the accepted idea is that most of them migrate to the north. In Persia they spend the summer and the following winter hiding at the roots of scrub on mountain sides, and near cities there are well-known places where they congregate in thousands and are collected and destroyed by forced labour, and there are probably similar congregating places in the mountains of Iraq that it would be worth while discovering.

Native plantations of tobacco were attacked by a flying swarm of *Schistocerca gregaria*, Forsk. Hoppers of this species were seen on 27th June, at an altitude of about 4,000 ft., eating the tough, leathery leaves of evergreen oak scrub. There is evidence that a summer generation (or possibly two) develops in Iraq from eggs laid by the

spring immigrants, but that extremes of climate prevent the locusts from becoming established permanently. A list of the other Acridids and Tettigoniids found includes *Dociostaurus maroccanus*, Thunb., the other important migratory locust in Iraq. In the hillside orchards visited, the fruit was mainly a small kind of greengage, the flesh of which was badly damaged by the adults of *Rhynchites auratus*, Scop. A few individuals of the Pentatomid, *Piezodorus incarnatus*, Germ., which is occasionally a serious pest in Italy, were also taken on greengages.

Newell (W.). **Special Report of Plant Commissioner to State Plant Board, Gainesville, Florida, April 1929.**—*Mon. Bull. Florida Pl. Bd.*, xiii, no. 8–10, pp. 122–124. Gainesville, Fla., April 1929.

Owing to the discovery of larvae of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in grapefruit from Orlando, Florida, on 6th April, a rapid survey was made of fruit plantings in Orange and Seminole Counties, and 12 properties containing 445 acres of *Citrus*, comprising an area about 12 miles by 6, were found, in the course of a week, to be infested, some of them quite seriously. The destruction of fruit, etc., is being carried out on the properties where the fly occurs.

Rules and Regulations made by the State Plant Board pursuant to the Florida Plant Act of 1927.—*Mon. Bull. Florida Pl. Bd.*, xiii, no. 8–10, pp. 126–130. Gainesville, Fla., April 1929.

The text is given of the rules and regulations adopted by the State Plant Board of Florida on 15th April 1929 to prevent the spread of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) recently recorded for the first time from this State [see preceding paper]. They provide for the supervision of work on infested properties, restrict the movement of fruit, vegetables, soil and other materials from the infested area, and regulate the disposal of fruit and vegetable refuse.

Van Dyke (E. C.). **Two new Species of *Listronotus* (Coleoptera-Curculionidae).**—*Pan-Pacific Ent.*, v, no. 3, pp. 106–108. San Francisco, Cal., January 1929.

Listronotus impressus, sp. n., is described from California, where it occurs in rice fields.

Keen (F. P.). **The Western Pine Beetle attacks a new Host.**—*Pan-Pacific Ent.*, v, no. 3, p. 108. San Francisco, Cal., January 1929.

Dendroctonus brevicomis, Lec. (western pine beetle), the attacks of which were believed to be restricted to the Pacific Slope form of western yellow pine (*Pinus ponderosa*) and *P. coulteri*, has recently been found injuring living lodgepole pines (*P. contorta murrayana*) in Oregon. Extensive galleries had been formed, eggs had been laid and larvae had developed. Other trees were found in which the previous generation had reared broods. These trees were adjacent to infested western yellow pines, which were the preferred food-plant.

Ballou (C. H.). **Effects of Geranium on the Japanese Beetle.**—*J. Econ. Ent.*, xxii, no. 2, pp. 289–293, 4 pls., 1 ref. Geneva, N.Y., April 1929.

Preliminary data obtained in the course of observations carried out in 1928 in relation to the effect on *Popillia japonica*, Newm. (Japanese beetle) of the ingestion of cultivated geraniums (*Pelargonium* spp.), both in cages and in the field, indicated that paralysis beginning with the hind legs and progressing in the direction of the head results from feeding on these plants. About 35 per cent. of the paralysed beetles under observation died within 4 days, though the majority of the remainder recovered within 24 hours. The flowers appear to be more attractive to the beetles than the foliage, and the effect is heightened when the feeding takes place on plants exposed to sunlight. The action of the plant on the digestive tract of the beetles appears to be of a highly corrosive nature, the midgut of those dying from eating these plants becoming disintegrated within 24 hours and the soft contents of the body cavity within 48 hours.

Hallock (H. C.). **Known Distribution and Abundance of** *Anomala orientalis* **Waterhouse,** *Aserica castanea* **Arrow, and** *Serica similis* **Lewis in New York.**—*J. Econ. Ent.*, xxii, no. 2, pp. 293–299, 4 maps. Geneva, N.Y., April 1929.

Records are given of the range and general abundance in New York State of three oriental beetles closely related to *Popillia japonica*, Newm., *viz.*, *Anomala orientalis*, Waterh. (Asiatic beetle), first observed in 1920 at New Haven, Connecticut ; *Aserica castanea*, Arr. (oriental garden beetle), first collected in New Jersey in 1921 ; and *Serica similis*, Lewis, which was not recorded until 1927, when it was found at Westbury, New York. The area of turf injured by *A. orientalis* in New York in 1928 was nearly double that in which attacks were reported in 1927. Turf was uninjured in 1928, however, in two localities in which injury occurred in 1927, where a top dressing containing 5 lb. lead arsenate to 1 bushel soil for each 1,000 sq. ft. had been applied to the infested lawns. Infestation by *A. orientalis* is unevenly distributed, but is mainly confined to well-kept lawns. Infestations of *A. castanea* also tend to be uneven, but have frequently been found in land covered with tall unmown grass as well as in lawns. In one heavily infested locality 188,250 adults were captured in an electric light trap kept burning all night during the summer months, 21,000 being captured in a single night when the temperature did not fall below 72° F. The larval population was found in some instances to be as high as 150 to the square foot, but in the locality suffering the greatest damage to foliage only 45 larvae were found to the square foot.

Richmond (E. A.) & Metzger (F. W.). **A Trap for the Japanese Beetle.**—*J. Econ. Ent.*, xxii, no. 2, pp. 299–314, 3 pls., 4 graphs, 2 refs. Geneva, N.Y., April 1929.

An account is given of four years' experience relative to the evolution of a trap for *Popillia japonica*, Newm., a description of which has already been noticed from a previous paper [*R.A.E.*, A, xvii, 421], together with the formula for the most satisfactory bait employed. In addition to the use of a tin " baffle " suspended over the mouth of the funnel, which increased the catch by 10·6 per cent., the following

modifications have been found to increase the efficiency of the trap : placing a receptacle containing water immediately under the trap, whereby its efficiency was almost doubled, many beetles being caught in the water ; the use of a tier of four funnels, which caught more beetles than a single one ; and painting the trap green. Other types of trap tested proved unsatisfactory. Nearly three times as many females as males were captured by the traps, which appear to be effective indicators of beetle abundance in any locality. Studies of comparative abundance made in different localities during the same year as well as over a period of years indicate that temperature and humidity are important factors influencing beetle collections. Although over a million beetles were taken between 29th July and 19th August 1926 in 25 traps placed in trees in an orchard, injury by *P. japonica* was not prevented. Equally unsuccessful results were obtained in later experiments in which traps were suspended on posts 5 ft. apart in a row parallel to the side of the orchard. A strip of cheesecloth was stretched from post to post just above the traps and sprayed on favourable days with a 0·4 per cent. geraniol emulsion. A tub of water was placed between every fourth and fifth post with enough geraniol to form a film over the water. In spite of these unsuccessful results, it is believed that an orchard might be protected in this way, if it were surrounded by a sufficient number of traps placed at the right distance from the orchard and supplied with bait of proper concentration.

Although the trap is practically specific for adults of *P. japonica*, a few individuals of the following species were also caught : *Ophistomis luteicornis*, F., *Typocerus velutinus*, Oliv., and *Chauliognathus marginatus*, F.

Fleming (W. E.) & Baker (F. E.). **The Hot-water Treatment of Nursery Plants.**—*J. Econ. Ent.*, xxii, no. 2, pp. 314–317, 1 ref. Geneva, N.Y., April 1929.

The hot water treatment to destroy the immature stages of *Popillia japonica*, Newm. (Japanese beetle) [*R.A.E.*, A, xvii, 175] was applied to 164,000 nursery plants during the dormant season of 1927–28. The effect on the 59 species handled is indicated ; 26 were successfully treated, 3 showed slightly retarded development and 30 were more or less severely injured. The cause of failure of the treatment has not yet been established in regard to many varieties, but as several species of plants injured under commercial conditions have been successfully treated under experimental conditions, a change in nursery procedure would probably give improved results.

Safro (V. I.). **Some Observations on Japanese Beetle Injury. Part I. Unsprayed Communities.**—*J. Econ. Ent.*, xxii, no. 2, pp. 317–319. Geneva, N.Y., April 1929.

The factors affecting the occurrence and degree of injury by *Popillia japonica*, Newm., to shade trees in districts where spraying is not carried out are discussed with a view to facilitating the organisation of spray programmes. Immune and susceptible types of trees are briefly enumerated, and the conditions under which susceptible trees may be omitted from the spraying programme are indicated. An attempt to observe the conditions affecting the normal food preferences of the beetles for shade trees indicated that exposure to sunlight, rapidity

of growth and proximity to favourite breeding grounds favour attacks, whereas a shady environment is a repellent factor. Other factors being equal, young trees seem to be more susceptible to attack than older ones, and unhealthy trees that still maintain a good rate of growth are apparently more susceptible than trees of the same species but of a healthier type.

McLeod (G. F.). **Some Observations on Japanese Beetle Injury. Part II. Sprayed Communities.**—*J. Econ. Ent.*, xxii, no. 2, pp. 320–322. Geneva, N.Y., April 1929.

Some results are given of a spraying demonstration for the suppression of *Popillia japonica*, Newm., carried out in a district in Pennsylvania in which over 20,000 trees and shrubs received 77,525 U.S. gals. lead arsenate coated with lead oleate. The fact that injury to sprayed plants well within the treated area was less than among those on the outer boundary indicated the value of co-operative spraying. A small amount of protection was afforded to unsprayed plants where they were surrounded by sprayed properties, but subsequent defoliation occurred in most cases. Properly sprayed plants received foliage protection of from 80 to 90 per cent. for a period of about 3 weeks. A list is given of a number of species ordinarily considered immune or only occasionally attacked that suffered injury in an area where all the normal food-plants had been sprayed. No large numbers of dead beetles were found in the sprayed district, but the operation resulted in driving off the insects present at the time and materially reduced possible later infestation within the area treated.

Friend (R. B.). **The Control of the Asiatic Beetle in Lawns.**—*J. Econ. Ent.*, xxii, no. 2, p. 323. Geneva, N.Y., April 1929.

This paper, of which only an abstract is given, deals with the control of the larvae of *Anomala orientalis*, Waterh. (Asiatic beetle) by the application of lead arsenate to the soil. The lead arsenate may be sprinkled over the lawn as a suspension in water at the rate of 3 lb. to 100 sq. ft., or mixed with a top dressing of loam or incorporated in the upper inch of lawn soil at the rate of 2 lb. to 100 sq. ft. Lawns should be treated before 1st August.

Turner (N.). **Variation in Resistance of Aphids to Toxic Sprays.**—*J. Econ. Ent.*, xxii, no. 2, pp. 323–326, 6 refs. Geneva, N.Y., April 1929.

An account is given of a series of tests carried out to determine the variations in the resistance of Aphids to 40 per cent. nicotine sulphate, 1 : 800. A simple method of applying contact insecticides by an adaptation of an apparatus previously noticed [*R.A.E.*, A, xii, 225] is described. Among the 7 species subjected to test, mortality varied from 41·3 to 77·4 per cent., and further tests confirmed the results within 5 per cent. Variations in the resistance of different species to the same spray applied under the same conditions should always be taken into consideration in reporting tests of contact insecticides.

Driggers (B. F.). **Experiments with Talc and other Dusts used against recently hatched Larvae of the Oriental and Codling Moths.**—*J. Econ. Ent.*, xxii, no. 2, pp. 327–334. Geneva, N.Y., April 1929.

Preliminary laboratory tests indicated that coarsely ground mica, such as is used as a lubricant in car tyres, is effective when dusted on peach foliage against young larvae of the oriental peach moth [*Cydia molesta*, Busck]. The percentage of larvae killed before reaching a point of entry was 88·5 and 100 respectively on wet and dry foliage. Further insectary tests with a number of dusts used as mechanical barriers against young larvae showed that 200-mesh talc and mica kill a high percentage of larvae of *C. molesta* hatching from eggs on peach foliage dusted with these materials. Of four finer dusts only one, china clay, killed as many as 90 per cent., and coarse dusts killed considerably less. Fine dusts killed more than twice the number of larvae killed by coarse dusts. Limited field tests showed that talc sticks better and is much more effective than mica or hydrated lime [*cf. R.A.E.*, A, xvii, 388] in reducing larval entry into peach twigs. Limited insectary tests with talc and mica dusted on foliage containing the eggs of the codling moth [*C. pomonella*, L.] showed that both materials are toxic to the young larvae. Mica dust (200-mesh) killed 100 per cent. of the larvae, and talc dust 72·7 per cent.

Glasgow (H.). **Mercury Salts as Soil Insecticides.**—*J. Econ. Ent.*, xxii, no. 2, pp. 335–340. Geneva, N.Y., April 1929.

Though mercury bichloride is a valuable insecticide against root maggots on crucifers, injury to certain crops has occasionally followed its use. A study of other mercury compounds was therefore made, and mercurous chloride proved the safest and most effective in experiments against *Phorbia* (*Hylemyia*) *brassicae*, Bch. (cabbage maggot), *Psila rosae*, F. (carrot rust fly) and *Hylemyia antiqua*, Mg. (onion fly). This insecticide, which was applied in an aqueous suspension at the rate of 1, 4 and 8 oz. to 10 U.S. gals. water, or as a 4 per cent. dust in an inert carrier, either drilled in with the seed or used to coat it before sowing, promises to be exceedingly useful in the treatment of tender crops, such as cauliflower or celery in seed beds, as well as in certain types of greenhouse work. In addition to its insecticidal properties, it appears to have considerable fungicidal value in checking certain seed-bed diseases.

Miller (R. L.). **Manganese Arsenate as a Control for the Codling Moth.**—*J. Econ. Ent.*, xxii, no. 2, pp. 340–345, 2 pls. Geneva, N. Y., April 1929.

The results of a season's intensive studies in Ohio and Washington indicate that manganese arsenate, when used in the laboratory alone or with lime-sulphur, is not quite as effective in preventing the entrance of newly hatched larvae of the codling moth [*Cydia pomonella*, L.] into carefully sprayed apples as is lead arsenate (1–1¼ lb. manganese or lead arsenate to 50 U.S. gals. water). When mixed with lime-sulphur or lime and lime-sulphur (1¼–1¾ lb. manganese or lead arsenate, 1–3 lb. lime, 1–1¼ U.S. gals. lime-sulphur to 50 U.S. gals. water), there was little difference in the effectiveness of the two materials. The addition of lime, lime-sulphur, or both, decreased the efficiency of both the arsenates. Equal or superior results were secured in field experiments

with manganese arsenate when mixed with lime-sulphur to those obtained with a similar mixture with lead arsenate, but lead arsenate was slightly better than manganese arsenate when each was used alone. The residue of manganese arsenate was more easily removed than that of lead arsenate. The use of a spreader prevented heavy residue spotting, which was sometimes caused by the application of manganese arsenate to certain early varieties of apple. No injury to foliage resulted from the use of this substance in Ohio, though some cases of severe scorching were reported from Washington. An account is given of the laboratory and field methods employed during the experiments.

In laboratory tests in which lead arsenate and manganese arsenate were sprayed at the rate of 2 lb. to 50 U.S. gals. water on potato foliage artificially infested with *Leptinotarsa decemlineata*, Say (Colorado potato beetle), 89·3 per cent. of the larvae were killed in five days by each material. Both of them failed to control *Epicauta pennsylvanica*, DeG. (black blister beetle) at the rate of 4 lb. to 50 U.S. gals. water, but as a dust at full strength both killed 72 per cent. in 48 hours. Beetles sprayed with 4 lb. manganese arsenate in 50 U.S. gals. 2 per cent. Volck were all killed in 48 hours, and no injury was caused to aster foliage.

DeLong (D. M.). **The Role of Bordeaux Mixture as a Leafhopper Insecticide.**—*J. Econ. Ent.*, xxii, no. 2, pp. 345–353, 1 pl., 5 refs. Geneva, N.Y., April 1929.

Comparative tests in the control of *Empoasca fabae*, Harr. (potato leafhopper) on both potato and bean, carried out during the past three seasons, showed that pyrethrum extracts, though they have an immediate action upon the leafhoppers, do not affect nymphs hatching a few hours after treatment, whereas Bordeaux mixture ensures delayed but certain mortality among the individuals present and continued lethal action for a considerable length of time after application, which effectively controls nymphs hatching after treatment.

In the first of a series of more detailed experiments carried out in 1928, in which the crop was sprayed as usual when *E. fabae* was already present, nymphs of all stages were dead 24 hours after spraying, only 5 per cent. of the population remained at the end of 4 days, and at the end of 6 days all leafhoppers were dead. Untreated plants under similar conditions showed 85 per cent. survival of the leafhoppers at the end of 6 days. Further tests showed that the leafhoppers died within approximately the same period when placed on previously treated plants, whether spraying had been carried out a few hours or 15–23 days beforehand. Leafhoppers which were thoroughly wetted with Bordeaux mixture and then placed on untreated plants remained unaffected and fed and developed naturally, less than 5 per cent. dying within 6 days of spraying. Leafhoppers placed on plants from which all residues had been carefully washed after treatment died in 4 or 5 days. Further experiments in which the leafhoppers were permitted to feed upon sprayed plants, but were prevented by means of special feeding cells from coming in contact with the spray material, indicate that the copper from the spray is absorbed by the plant and demonstrate that Bordeaux mixture has a direct insecticidal action upon the leafhoppers. Standard Bordeaux 4–4–50 was used in most of the tests, 6 lb. hydrated lime being substituted for 4 lb. stone lime in most cases.

Comparative tests with different quantities of copper sulphate ranging from 1 to 5 lb. indicate that even a relatively small percentage of copper is effective for leafhopper control and that it is probably not necessary to use as strong a mixture as has been customary hitherto. Bordeaux mixture dusts, when dry, have a definitely repellent action, but when dusted upon a wet plant surface, they seem to act in very much the same way as sprays of Bordeaux mixture.

Hartzell (A.). **Tolerance of different Species and Varieties of Plants to Naphthalene Vapour.**—*J. Econ. Ent.*, xxii, no. 2, pp. 354–360, 1 pl., 9 refs. Geneva, N.Y., April 1929.

An attempt is made in this paper to assemble the results of tests carried out over the past two years to determine the tolerance to naphthalene fumigation with concentrations of 1·5 oz. and 2 oz. to each 1,000 cu. ft. of greenhouse space of 150 species and varieties of plants [*R.A.E.*, A, xiv, 656]. Dahlias proved to be one of the most tolerant species. About 30 species, many of which belonged to the genus *Nicotiana*, were severely affected by marginal scorching when fumigated at the higher concentration. The stage of growth of the plant appears to have an important bearing upon tolerance, the older leaves being more sensitive to naphthalene injury than young, tender foliage. Single fumigations at the higher concentration were effective in the control of *Tetranychus telarius*, L. (red spider), *Heliothrips femoralis*, Reut., and *Thrips tabaci*, Lind., for which naphthalene shows an apparent selective toxicity. At the lower concentration, repeated fumigations at intervals of 4 or 5 days were necessary to obtain satisfactory control.

Ginsburg (J. M.). **A Correlation between Oil Sprays and Chlorophyll Content of Foliage.**—*J. Econ. Ent.*, xxii, no. 2, pp. 360–366, 11 refs. Geneva, N.Y., April 1929.

No injury to foliage resulted from several spray applications of a highly refined lubricating oil during July and August to two varieties of apple. The leaves of these trees were darker, appeared more vigorous and fell later than those of either unsprayed trees or trees that received other sprays. Chemical analysis showed that the oil-sprayed leaves of both varieties contained appreciably more chlorophyll than did the leaves from the unsprayed trees. The author discusses the problem of the physiological response of apple foliage following spraying and advances various possible explanations for the higher chlorophyll content.

Eddy (C. O.) & Geddings (E. N.). **Determining Hydrocyanic Acid Gas Concentration in Fumigation Experiments.**—*J. Econ. Ent.*, xxii, no. 2, pp. 366–378, 5 figs., 1 ref. Geneva, N.Y., April 1929.

The following is the authors' abstract : The concentration of hydrocyanic acid gas in a large room fumigated with Cyanogas calcium cyanide was determined by removing fixed quantities of air during definite periods at selected times by an aspirator system, passing the samples through small volumes of 3·5 per cent. sodium hydroxide solutions, and calculating the parts per million from analytical results secured by using a modification of the Leibig method [by this method the cyanide present is titrated with a standard silver nitrate solution,

potassium iodide being used as an indicator]. No consistent difference was noted in the concentration of gas at different elevations. The rate of decrease was directly proportionate to the initial concentrations. The decrease was most clearly marked during the first five hours. Higher initial concentrations of gas per unit of calcium cyanide were derived from lower dosages. An increase in concentration usually occurred during the first two or three hours with dosages above 4 oz. per 1,000 cu. ft.

ROARK (R. C.). **Recent Progress in the Chemistry of Derris.**—*J. Econ. Ent.*, xxii, no. 2, pp. 378–381. Geneva, N.Y., April 1929.

The following is taken from the author's abstract : The insecticidal principle of the root of *Derris elliptica* is "rotenone," a white crystalline material, $C_{23}H_{22}O_6$, melting point 163° C., soluble in ether, acetone and oils, but insoluble in water. It contains two methoxyl groups and a ketone group, but its constitution is as yet unknown. It was called rotenone from the Japanese name of the plant "roh-ten" by Nagai, who first isolated it in 1902.

Dried derris root contains from 0·5 to 6 per cent. rotenone. Rotenone is stable in the dried root or in solution in oil, but decomposes on contact with water or alkalies. For this reason soap emulsions containing rotenone should be prepared only shortly before using. According to Japanese experimenters, rotenone decomposes within 2 days after application to foliage, and vegetables sprayed with it may therefore be subsequently eaten with impunity.

ROARK (R. C.) & NELSON (O. A.). **Maximum Weights of various Fumigants which can exist in Vapor Form in a 1,000 Cubic Foot Fumigating Chamber.**—*J. Econ. Ent.*, xxii, no. 2, pp. 381–387, 8 refs. Geneva, N.Y., April 1929.

The following is taken from the authors' abstract : Formulae are presented by means of which it is possible to calculate the maximum number of pounds of a fumigant (whether a gas or a liquid or solid) which can vaporise in an enclosed space of 1,000 cu. ft. at temperatures ranging from 32° F. to 122° F. under a pressure of 1 atmosphere (760 mm. of mercury). Tables show data for 26 compounds, including commonly used fumigants such as hydrocyanic acid gas, carbon bisulphide, paradichlorobenzene and nicotine.

HAMILTON (C. C.). **The Growth of the Foliage and Fruit of the Apple in Relation to the Maintenance of a Spray Coating.**—*J. Econ. Ent.*, xxii, no. 2, pp. 387–396, 6 graphs. Geneva, N.Y., April 1929.

This paper gives an account of the last of three seasons of investigation of the effect of growth on the adherence of lead arsenate to the foliage and fruit of apple [*R.A.E.*, A, xv, 432 ; xvi, 136]. Methods are presented by means of which the increase of leaf area on the trees was ascertained at weekly intervals, and a description is given of the technique employed in collecting and determining the quantity of arsenic trioxide upon samples of fruit and foliage collected each week throughout the growing season. The relation between the increase in size of the foliage and of the apples and the quantity of arsenic trioxide present upon them, as indicated in the data taken from week to week, is then discussed. A direct relationship was found to exist

between the increase in leaf area and the decrease in the arsenical residue upon the leaves, the rapidity of the decrease in arsenical residue being proportional to the rapidity of increase in the leaf area. As the greater part of the foliage had developed by the time the last spray was applied on 29th June, loss of arsenical residue after that date was mainly due to weathering. The reduction of arsenic trioxide upon the leaves occurring between 10th July and 14th September, when the experiment was discontinued, amounted to approximately 66 per cent.

The reduction in the quantity of arsenic trioxide per unit area of apple or per pound of fruit from 29th June to 14th September was mainly due to increase in growth, and since the apples had attained almost half their final diameter, but only a quarter of their final surface area and one-seventh to one-ninth of their final volume by 29th June, any sprays applied before 1st July would not greatly influence the final amount of arsenic found upon the fruit at picking time. The loss of arsenic trioxide on the apples as a result of weathering was proportionally much smaller than that which occurred on the foliage.

Gui (H. L.). **Notes on the Potato Scab-gnat,** *Pnyxia scabiei* **(Hop.).**— *J. Econ. Ent.*, xxii, no. 2, pp. 397–399, 8 refs. Geneva, N.Y., April 1929.

An account of *Pnyxia scabiei*, Hopk. (potato scab gnat), the history and distribution of which are briefly discussed, is given as the result of observations made since 1926, when an outbreak occurred on seed potatoes in west-central Ohio. Surveys in 1926, 1927 and 1928 showed that 6, 3 and 4·5 per cent. of all the potatoes grown in central and northern Ohio were injured, as compared with 15, 12 and 9·8 per cent injured by wireworms and 2, 2 and 0·45 per cent. by white grubs [*Lachnosterna*]. *P. scabiei* may become sufficiently numerous on seed pieces in the spring to effect a material reduction in the yield and may also attack the crop during the growing season and impair its market value. Soils having a high pH value, or a low organic matter and moisture content are conducive to injury by *P. scabiei*, and it is therefore preferable to derive organic matter and nitrogenous fertilisers from sources other than the legumes which grow only in soils having a high pH value. A reduction in losses from this Mycetophilid may be effected by growing potatoes in acid soils with a high organic content.

Wilson (H. F.) & Whitcomb, jr. (W.). **The Status of the Onion Maggot (*Hylemyia antiqua* Meig.) in Wisconsin.**— *J. Econ. Ent.*, xxii, no. 2, pp. 400–405. Geneva, N.Y., April 1929.

Hylemyia antiqua, Meig. (onion maggot) is widely distributed in Wisconsin, where it is gradually becoming more destructive with extended cultivation and more intensive plantings of onion. A brief account is given of the control measures hitherto tried [*R.A.E.*, A, xiii, 245, 517], none of which has proved entirely satisfactory. Onions are usually planted about the end of April and weeded 4–8 times in the season. Increasing damage by *H. antiqua* has necessitated the employment of 90–100 lb. seed where 60 lb. was formerly considered sufficient. After removal of the bulbs at harvest, the tops are left along the sides of the field where they harbour the third brood larvae, which pupate in the rotting mass or in the soil. *H. antiqua* probably hibernates almost entirely in the pupal stage, though a few adults

may also overwinter. Flies were first observed in numbers on 27th April. The eggs, which are laid in spots protected from the prevailing winds, hatch in 3–5 days, and the larvae burrow into the young onions, in which they live for 15–18 days before pupating. One larva may injure several onions when the plants are small. The pupae are found in the soil, usually at about the level of the bulbs, but sometimes at a depth of 5–6 inches, the last brood pupating much deeper in the soil than the preceding ones. Infestation was heavy near the edges of most of the plots observed, but less so in the centre. In the spring, flies were as numerous on potatoes as on onions.

The first brood larvae, which cause the greatest damage, attack sets to a much greater extent than large onions. The second brood does little damage, and infestation is about equal on sets and large onions, a large proportion of the eggs being laid on or round plants already dying from rot or smut. Damage done by third brood larvae is negligible, as the onions are full grown and ready for harvest. Many pupae go into storage with the onions, as many as 40 having been found in a bushel of bulbs, but it is doubtful whether they emerge as adults.

Huckett (H. C.). **A Contribution to the Study of Control Measures for Cucumber Beetles,** *Diabrotica duodecimpunctata* **Oliv. and** *vittata* **Fabr.**—*J. Econ. Ent.*, xxii, no. 2, pp. 405–411. Geneva, N.Y., April 1929.

Experiments in the control of *Diabrotica duodecimpunctata*, Oliv., and *D. vittata*, F., carried out on Long Island indicated that under controlled conditions the effectiveness of nicotine dusts was dependent on relatively dry environmental conditions, direct contact of the dust with the beetle and heavy applications. It was also found that a number of arsenical and non-arsenical hydrated lime dust mixtures, as well as pure hydrated lime, were effective as insecticides under these conditions. The results of studies carried out under favourable and unfavourable environments indicated that under natural conditions such factors as high atmospheric humidity, precipitation, dew and, indirectly, cracks in the soil, reduce the effectiveness of the dusts, whereas low atmospheric humidity, drought and dusty conditions serve to increase their effectiveness. It was also indicated that the active principle of hydrated lime dust, whether arsenical, non-arsenical or nicotine, was of less importance than these factors, especially where they tended to approach the optimum for effective treatment.

Glasgow (H.) & Gaines (J. G.). **The Carrot Rust Fly Problem in New York.**—*J. Econ. Ent.*, xxii, no. 2, pp. 412–416, 1 fig. Geneva, N.Y., April 1929.

As the result of four years' study of *Psila rosae*, F. (carrot rust fly), a serious pest of carrots in New York State, where there are two main broods and a partial third, several effective methods of control have been evolved. The emergence of first brood flies from the overwintering puparia begins about 20th May and lasts about a month, the peak being reached about 1st June. After an interval of about a month, during which the flies are absent, the second generation begins to appear at the end of July and continues to emerge until 1st September, reaching its peak about 1st August. Flies of the third brood begin to appear in the field by the last week in September and continue to

emerge until the latter part of November or even into December. In the case of large scale production, comparative freedom from injury can be secured by the elimination of early plantings of carrots, celery or parsnips to deprive the first brood of food-plants, and planting the main crop of carrots after the middle of June. By this method the fly is practically exterminated, and a clean crop of carrots can be produced the same season. An alternative method, which gives satisfactory commercial control with a somewhat reduced yield, is to plant the main crop after 1st June and harvest before the middle of September. Properly constructed cheesecloth screens or mercurous chloride applied either as a dust or in aqueous suspension will give effective control of *P. rosae* in comparatively small plantings. The comparative value of a number of soil insecticides that have shown a high degree of control in the case of moderate infestations is indicated in a table, the mercury compounds being the best.

Felt (E. P.). **The Need for Investigations on Shade Tree Insects.**—*J. Econ. Ent.*, xxii, no. 2, pp. 417–420. Geneva, N.Y., April 1929.

Attention is drawn to the importance of systematic protection of shade trees from insect pests. Although these trees are an important feature of the 13,000,00 acres of national, state, county and municipal parks of the United States, and large numbers are found on the highways and in private grounds, they have escaped the interest of the forester, the horticulturalist and the nurseryman alike, and little consideration has hitherto been bestowed upon them. It is suggested that a proportion of the £6,000,000 expended annually on the upkeep of recreation grounds should be allotted to keeping shade trees in good condition and protecting them from the depredations of insects.

Guyton (T. L.) & Stear (J. R.). **Field Corn injured by Larvae of *Sidemia devastatrix*.**—*J. Econ. Ent.*, xxii, no. 2, pp. 420–421. Geneva, N.Y., April 1929.

Slight injury by the larvae of *Sidemia devastatrix*, Brace, was observed in a maize field in Pennsylvania in June 1928, the attack being apparently confined to the higher, dryer portions of the field. The plants attacked were about 12–18 ins. high when inspected, and feeding had occurred about 1 in. below the surface of the ground, the stalks being almost eaten off. The larvae, which are briefly described, did no more apparent feeding when placed on maize plants in the laboratory, where adults emerged on 23rd July.

Whelan (D. B.). *Supella supellectilium* (**Serville**), **a Household Pest in Nebraska.**—*J. Econ. Ent.*, xxii, no. 2, p. 421. Geneva, N.Y., April 1929.

Supella supellectilium, Serville, is recorded for the first time from Nebraska, where both nymphs and adults were collected in the kitchen of a house in January 1929. It is thought that this cockroach, which has been previously known in the United States only from the extreme south of Florida, reached America from the eastern hemisphere by means of commerce and was probably accidentally introduced into Nebraska by way of the West Indies.

Felt (E. P.). **Hickory Leaf Gall Midges,** *Caryomyia* **species.**—*J. Econ. Ent.*, xxii, no. 2, p. 422. Geneva, N.Y., April 1929.

A description is given of the oviposition habits of *Caryomyia* sp. on leaf shoots of hickory in Connecticut in May 1928, 50–500 eggs among the hairs on the lower surfaces of the leaves being present on individual leaflets. The resulting galls, which were of two well-marked types, are described.

Barnes (D. F.) & Potts (S. F.). **A Disease differing from Wilt observed in Gipsy Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 2, p. 423. Geneva, N.Y., April 1929.

In the course of testing the toxicity of lead arsenate to the various larval stages of the gipsy moth [*Porthetria dispar*, L.] in 1928, heavy mortality was seen to occur in the third stage, both in the control and poisoned rearing trays, which could not be attributed either to the result of the insecticide or to polyhedral disease. The appearance of the larvae indicated that *Streptococcus disparis* might possibly be the cause of death [*R.A.E.*, A, vi, 568]. Although in most cases a gram-positive *Streptococcus* resembling *S. disparis* was found in dead larvae examined, infection experiments were not performed, and detailed studies are needed to determine fully the cause, manner of spread and economic importance of the disease in the field.

Doucette (C. F.). **A Tarsonemid Mite attacking Narcissus.**—*J. Econ. Ent.*, xxii, no. 2, pp. 423–424. Geneva, N.Y., April 1929.

Several widely scattered infestations of a Tarsonemid mite on narcissus bulbs during the past 3 years in various parts of the United States appear to be due to *Tarsonemus approximatus*, Banks, var. *narcissi*, Ewing [*R.A.E.*, A, xvii, 310]. Most of these infestations occurred on stock that had been grown 1–5 years in the same locality and included both the polyanthus and hardy types of narcissus. Two cases of heavy infestation, however, occurred in greenhouses on bulbs imported directly from Holland. Some of these bulbs were free from mites, while others grown under the same conditions and traceable to definite shipping crates, showed almost 100 per cent. infestation. The injury, which may easily be mistaken for that caused by *Tylenchus dipsaci*, is described. The mites develop very slowly under cool climatic conditions but multiply very rapidly when the bulbs are forced under glass, and often become so numerous that complete loss of the flower crop results. Preliminary tests indicate that immersion in hot water at 110° F. will kill the mites in 30 minutes, but little is known as to the possibilities of reinfestation.

McAlister, jr. (L. C.). **Preliminary Report on Control of Hibernating Codling Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 2, pp. 424–425. Geneva, N.Y., April 1929.

The results are given of preliminary studies in the winter of 1927–28 to discover an insecticide for the overwintering larvae of the codling moth [*Cydia pomonella*, L.]. Mature larvae collected in October 1927 from beneath burlap bands placed round the trunks of apple trees were allowed to spin their cocoons between strips of apple bark held together by rubber bands. These were treated with a

number of materials and kept in an outdoor insectary until the following spring, when they were observed for moth emergence and subsequently examined for dead larvae. Kerosene and tetrachlorethane, both of which were used undiluted, gave the best results and killed all the larvae.

WISHART (G.). **Large Scale Production of the Egg Parasite** *Trichogramma minutum* **Riley.**—*Canad. Ent.*, lxi, no. 4, pp. 73–76, 3 figs. Orillia, Ont., April 1929.

Work on the production of *Trichogramma minutum*, Riley, carried on since January 1928 at Chatham, Ontario, included the production of eggs of *Sitotroga cerealella*, Ol., as hosts for the parasite. This moth, the eggs of which have proved the most satisfactory for breeding *T. minutum*, is not an established pest in Canada, and it has to be kept in incubators throughout the year, as it cannot withstand the winter temperatures. The method employed is essentially the same as that used by Flanders [*R.A.E.*, A, xvii, 383]. The moths are reared in a specially built incubator in which the temperature is maintained at 82° F. and the relative humidity above 50 per cent., preferably 70 per cent. Either maize or wheat may be used as food for the larvae, but maize produces larger moths, and white dent maize has proved particularly satisfactory for the purpose. It was found necessary to superheat all maize before using, to insure freedom from mites, and to clean out the incubators frequently. The moths are collected from the incubator by means of a vacuum collector. The maize starch at the bottom of the oviposition cages, in which the moths lay their eggs, is removed daily and the eggs separated from it by sifting through a 60-mesh bolting cloth sieve. The clean eggs are fastened to 3 inch round paper cards with thin shellac and exposed to *T. minutum* in a petri dish containing half a card of parasitised eggs from which the parasites have just started to emerge. The dish is kept in a temperature of 80–83° F. and exposed to moderately strong light from above. After 12 hours the first card is removed, and a fresh card of host eggs is placed with the parasites, the process being repeated at 12-hour intervals as long as there is an appreciable number of parasites alive. The parasitised eggs yield *T. minutum* in 8½ to 9 days when kept at a temperature of 80–83° F. Emergence is spread over about a day, but it can be accelerated by keeping the parasitised eggs in a dark place and slightly cooler from the beginning of the eighth day and then bringing them to a bright light and incubator temperatures at the beginning of the tenth day [see next paper].

The bins used for rearing the moths in the incubator are of dressed timber 2 ft. by 2 ft. by 4 ins. deep, and the covers are made of narrow slats placed ⅛ in. apart and running back to front. The covers are flush with the front and back of the bins, which are ⅛ in. lower than the sides. Heat is supplied by a bank of carbon lamps controlled by a thermostat. A water pan provides humidity, and evaporation is increased by having a carbon lamp immersed in the water. Heated air is circulated round the bins from the bottom of the incubator, where the lamps are placed, to the top, through a 40-mesh wire screen into the open space on the other side of the trays, through the spaces between the trays and down a narrow space on the further side. The moths are collected through a door in the side of the incubator. The vacuum collector is attached to an ordinary vacuum sweeper and is placed over the oviposition cage, into which the moths

fall, a screen cylinder preventing them from entering the cleaner, and a tin baffle moderating the draught directly opposite the sucking connection. Two adjustable vents in the outside are used to regulate the velocity of the suction. The size of the oviposition cage is adjusted to the number of moths, one $3\frac{1}{4}$ inches in diameter and $5\frac{1}{2}$ inches in height being adequate for up to 500 moths. The top has a removable lid allowing the cage to be attached to the vacuum collector, and the bottom is made of 20-mesh bronze wire screening. The cage is placed in a petri dish cover in which is enough maize starch to press up through the screen and to cover it sufficiently.

WISHART (G.). **Note on the Rearing of** *Trichogramma minutum* **Riley.**—*Sci. Agric.*, ix, no. 9, pp. 616–617. Ottawa, Ont., May 1929.

The method of rearing *Trichogramma minutum*, Riley, on eggs of *Sitotroga cerealella*, Ol., described in the preceding paper, resulted in a waste of host eggs when parasitism was poor and a loss of possible infestations when it was better than was anticipated. It was thought that if emergence of *T. minutum* could be spread over a shorter period, these difficulties would be obviated, and it was found by experiment that if the parasitised eggs are kept in the dark, very few of the parasites have emerged at the end of the period required for total emergence when using the previous method. If they are then placed in strong light, emergence is rapid and complete, and pairing takes place immediately. Under these conditions a greater number of parasitisms was secured on one card bearing an abundant supply of host eggs than on all the cards used in the old method. Practically all the adult parasites are dead in 24 hours, and no further cards of eggs are required. The ratios of reproduction obtained by this method have never been below 6 to 1 and have sometimes been as high as 11 to 1. Better pairing is secured when all the parasites emerge over a short period, and there is, consequently, a marked increase in the proportion of females secured. It is also thought that when liberations are to be made in test plots at fixed times, it will be of distinct advantage if all the individuals of *T. minutum* emerge when desired.

STEENBURGH (W. E.). **Laboratory Rearing of** *Laspeyresia molesta* **Busck.**—*Sci. Agric.*, ix, no. 9, pp. 617–618. Ottawa, Ont., May 1929.

Laboratory rearing of *Cydia* (*Laspeyresia*) *molesta*, Busck (Oriental peach moth) was undertaken to determine a satisfactory method of breeding this insect that would ensure a constant and plentiful supply for use in rearing its parasites. Experiments were carried out in specially constructed incubators kept at a temperature of 80–85° F. Larvae were collected from peaches and quinces in the autumn of 1928 and kept in cold storage at a temperature of 33° F. The first larvae were removed after three weeks, allowed to warm slowly and then placed in an incubator ; others were removed as needed over a period of three months. Emergence began on the 10th day and continued over an extended period, the maximum occurring between the 14th and 21st days. The percentage of emergence secured from the different lots of larvae varied directly with the time they had remained in cold storage, the first larvae giving an emergence of 41 per cent., and those used three months later 71 per cent. The moths obtained were used in

egg-laying experiments. Oviposition cages that gave good results in the insectary proved unsatisfactory for winter laboratory breeding (when the peach leaves that are necessary to incite oviposition cannot be secured), and the most satisfactory type of cage proved to be a modification of that used by Briand [*R.A.E.*, A, xvii, 395]. Approximately 100 females and an equal number of males were confined in the cage as it seemed necessary to crowd the insects to secure oviposition. More eggs are laid by each female if sliced apple is kept in the cage; the moths feed on the pulp and oviposit on the skin, distributing their eggs quite evenly between the epidermis of the apple and the waxed paper. During the day the moths, which live longer when a high humidity is maintained, are exposed to light, but oviposit at night when the cages are covered. The eggs cut from the waxed paper are kept in a moist atmosphere to prevent desiccation and placed on apples just before hatching. Twelve was found to be a suitable number for an apple of average size. Owing to the rapid growth of fungi in the warm moist atmosphere of the incubator, it was found necessary to keep the apples in another incubator where a much lower degree of humidity was maintained. Since a good circulation of air through the apples is also important, they were placed on metal trays with a top and bottom of wire screening (40-mesh). The mature larvae leave the fruit and, although they will not spin their cocoons on the smooth surfaces of the trays, they readily crawl into the openings of strips of corrugated cardboard 3-8 ins. wide and 4 ins. long placed round the inner surface of the tray just below the attachment of the top and held in place by small brackets soldered to the inside of the tray. The strips containing the larvae were removed every seven days and placed either in storage or in emergence cages. It has been found that moths from laboratory bred material live longer, are more active and have a shorter pre-oviposition period than collected ones. The females laid more eggs and the resulting larvae produced a much higher percentage of healthy moths. At present the work is being carried on entirely with laboratory bred material and is progressing satisfactorily.

RÉGNIER (R.). **Etat actuel de la question de l'acclimatation de l'*Aphelinus mali*, parasite américain du puceron lanigère.**—6 pp., 2 refs. Troyes, Association française pomologique, 1929.

The situation regarding the introduction of *Aphelinus mali*, Hald., into various countries for the control of the woolly aphis [*Eriosoma lanigerum*, Hausm.] is briefly surveyed. In Normandy and the region north of Paris the acclimatisation of this parasite has not been nearly so successful as in the Mediterranean regions where the summer climate more nearly resembles that of the United States. In the north of France, Normandy and England climatic conditions are much less favourable to the rapid reproduction of *A. mali*. Owing to the late appearance of *E. lanigerum* in spring, many of the parasites, which begin to emerge during the first part of April, die before they can find hosts on which to oviposit. Many of the Aphids are on the roots at this time, and parasitism of these individuals has never been observed. During the warm weather of May and June the Aphids increase rapidly, and those individuals of the second and third generations of *A. mali* that have survived begin to have an effect, and a corresponding increase in their numbers would be expected. Unfortunately, at this time, predators of *E. lanigerum* have become sufficiently numerous to

destroy large numbers of the host, and colonies of the Aphids must be protected from these enemies by muslin bags if attempts to establish *A. mali* are to be made in July. For these reasons *A. mali* is of only secondary importance in these regions, and the use of insecticides should be continued. The author suggests that it might be possible by selective breeding to obtain a race of *A. mali* that would appear later and be more active than the usual strain. In Italy, a race that appears early and is unusually active has already been observed [*R.A.E.*, A, xiii, 295].

Veitch (R.) & Simmonds (J. H.). **Pests and Diseases of Queensland Fruits and Vegetables.**—Med. 8vo, 198 pp., 64 pls. Brisbane, Queensland Dept. Agric. & Stock, 1929.

This handbook summarises present knowledge with regard to the commoner pests and diseases of Queensland fruits and vegetables. Certain chapters, dealing with insects and their anatomy and with fungi and bacteria, are included as an aid in the application of remedies. Some portions of the text have previously appeared in the *Queensland Agricultural Journal*.

Williams (C. H. B.). **Invasion de chenilles sur la canne.**— *J. Sta. agron. Guadeloupe*, vii, no. 2, pp. 80–84. Pointe-à-Pitre, 1929.

During the last quarter of 1928, a great deal of damage was done to standing crops (potatoes, maize, sugar-cane, etc.) in Guadeloupe by caterpillars, which entirely devoured sugar-cane up to a foot high, after migration from wild plants in the vicinity. The species identified were those of *Remigia* (*Mocis*) *punctularis* and *Laphygma frugiperda*. Adults of another Noctuid, *Cydosia histrio* (usually a pest of *Capsicum*) were also found, but it is not known whether the larvae attack sugar-cane. The remedies practised were mowing down all the vegetation bordering the cane fields and weeding the fields, especially those planted with young cane. Dusts composed of 1 part by weight of Paris green with 5 parts slaked and sifted lime, or equal parts of sodium fluosilicate and slaked and sifted lime were broadcast over the fields and seemed to act as a repellent as well as killing the larvae. The dusting had to be renewed after heavy showers. During the invasion, which lasted six weeks, some 50 acres of young cane were very seriously damaged, and in some cases the fields had to be replanted.

Boselli (F. B.). **Studi sugli Psyllidi (Homoptera: Psyllidae o Chermidae). I. Contributo alla conoscenza della Psylla del fico** (*Homotoma ficus* **L.). II. Descrizione di una nuova specie di** *Paurocephala* **della Cina e dei suoi stadii larvali. III. Appunti su alcune ninfe di Pachypsyllini.** [Studies on Psyllids. I. A Contribution to the Knowledge of the Fig Psyllid, *H. ficus*. II. A Description of a new Species of *Paurocephala* from China and of its larval Stages. III. Notes on some Nymphs of Pachypsyllini.]—*Boll. Lab. Zool. Portici*, xxi, pp. 218–251, 13 figs., 8 refs., pp. 251–264, 5 figs. ; xxii, pp. 204–218, 5 figs., 20 refs. Portici, 1929.

Historical notes are given on *Homotoma ficus*, L., with descriptions of all its stages. This Psyllid occurs in South Europe from Spain to the Caucasus. In Italy it is very common on *Ficus carica*, and it also

occurs and oviposits on capri figs. In Campania there is one generation a year. The adults appear at the end of May or early in June. They feed on the lower surface of the leaves during the summer. Mating occurs in September, and oviposition from the end of September to early October. The eggs, which are laid on the branches, preferably the lower ones, hatch from about mid-March to early April. This Psyllid is not harmful, the blackening of the leaves being due to a sooty fungus associated with *Ceroplastes rusci*, L.

Paurocephala chonchaiensis, sp. n., is described from *Ficus* sp. in China, and the nymphs of *Pachypsylla venusta*, O.S., *P. celtidis-mamma*, Riley, and of an undetermined species are described.

CONTE (V.). **Contributo alla conoscenza della grillotalpa** (*Gryllotalpa gryllotalpa* **L.**). [A Contribution to the Knowledge of the Mole-cricket.]—*Boll. Lab. Zool. Portici*, xxi, pp. 275–301, 8 figs., 3 pp. refs. Portici, 1929.

A description is given of all stages of *Gryllotalpa gryllotalpa*, L., which caused much damage in the spring of 1927 in the province of Naples. Mating occurs in April after a period of almost complete inactivity in winter at a depth up to about 6 feet in the ground. The nests in which the eggs are laid are never more than 8 inches below the surface, most of them being at 4–6 inches. Compact soil such as occurs under paths and uncultivated ground are selected for the purpose. An average of 250–300 eggs is found in a nest. Incubation takes about 18 days. The larvae remain in the nest for several days. A few adults appear in July, but most of them emerge in August and September. They oviposit in the following spring. Areas in which there is a very hard subsoil at a depth of less than about 30 inches are never infested. Though lizards, moles and various birds prey upon mole-crickets, no parasites were observed.

Young plants may be protected by being surrounded by rings of metal or tarred cardboard, but the most practical measure is the collection and destruction of the nests in paths and similar infested areas.

VAN EMDEN (F.). **Ein Beitrag zur Kenntnis der Lebensgeschichte des Malvenflohkäfers** (*Podagrica fuscicornis* **L.**). [A Contribution to the Biology of the Mallow Flea-beetle, *P. fuscicornis*.]—*Z. wiss. InsektBiol.*, xxiv, no. 1–3, pp. 23–27, 14 refs. Berlin, 25th January 1929.

These observations were made near Halle a. S., Germany, where *Podagrica fuscicornis*, L., occurs on *Althaea rosea* var. *nigra*, *A. officinalis* and *Malva sylvestris*, which are grown for their medicinal properties. The first adults were seen in June, more usually on the leaves than on the flowers, and the former may become completely skeletonised. The larvae feed on the bark of the root-stem and were full-grown in October and November, though few of them had mined more than $\frac{2}{3}$ in. into the root. They apparently penetrate deeper into the ground in November and December, for some were found in April at 16–19 inches. In the laboratory pupation began in May, the adults emerging after 13–15 days. *P. fuscicornis* thus differs from other Halticines in that it hibernates in the larval and not in the adult stage.

Reh (L.). **Pflanzenschädliche Wanzen.** [Bugs injurious to Plants.]—*Z. wiss. InsektBiol.*, xxiv, no. 1–3, pp. 43–49. Berlin, 25th January 1929.

In view of the fact that little attention has been paid in Germany to the economic importance of plant-bugs, this survey of some of the injury done by them to crops in various parts of the world has been prepared.

Stich (R.). **Ueber Imaginalparasiten aus der Familie der Braconiden bei Käfern.** [On the Occurrence of Braconids that parasitise Beetles in the Adult Stage.]—*Z. wiss. InsektBiol.*, xxiv, no. 1–3, pp. 89–96, 7 refs. Berlin, 25th January 1929.

This is an annotated survey of existing records of the parasitism of adult beetles by Braconids, with some notes on the occurrence of such cases in Germany.

Kästner (A.). **Untersuchungen zur Lebensweise und Bekämpfung der Zwiebelfliege (*Hylemyia antiqua* Meigen). 1. Teil. Die Bekämpfung der Imago im Frühling.** [Investigations on the Biology and Control of the Onion Fly, *H. antiqua*. Part 1. Spring Measures against the Adult.]—*Z. PflKrankh.*, xxxix, nos. 2–3, pp. 49–97, 122–139, 4 figs., 4 pp. refs. Stuttgart, February–March 1929.

These investigations represent part of a study of *Hylemyia antiqua*, Mg., in the onion district of Calbe, Saxony. Only the summer generation can be dealt with by means of a poison-bait spray, the spring one, which is the one of most economic importance in Germany, being apparently unattracted by it. Separate investigations, which are described in detail, were therefore made on the attractiveness, sweetness and poisonousness of the bait. Onions cut in half proved to be very attractive, even when dipped in solutions of sugar and poison. The attraction is greatest when the solution is dry, probably because the odour of the onion is not fully perceptible through a liquid coating. The attraction is most marked from mid-May to the end of June, *i.e.*, during the flight of the spring generation. The visits of the flies to the bait depend greatly on the prevalent weather, heat, wind and heavy rain being particularly adverse. Even when dipped in sugary solutions it does not attract bees. For this bait 37–52 lb. of onions are required per acre, and they must not be very small. They remain effective even when quite dry. As a result of experiments with sweet substances, raw sugar was chosen for work in spring. It dries rapidly and does not ferment quickly, but is not an ideal material because it is much affected by rain.

The choice of a suitable poison was the subject of extensive tests. Zinc arsenite, zinc phosphate, barium chloride and ammonium fluoride were useless. Ammonium iodite was too expensive. Sodium fluosilicate, sodium fluoride, sodium arsenate, and sodium arsenite gave good results, especially the last. The tin method as used in America, the strewn bait, and the onion bait described above were tested and compared. The tins were filled with a solution containing $3\frac{1}{2}$ parts [beet] molasses, 2 parts sodium fluoride, and $94\frac{1}{2}$ parts water. The effect was good, very few plants being killed by the larvae, but this bait is much less attractive than the onion bait. For strewing, a bait consisting of

about 30 lb. oat-chaff and 2 gals. water containing 2 per cent. sodium fluoride and 3 per cent. molasses, was found to be insufficiently attractive.

In the experiments with the onion bait, the onions had been dipped in a saturated solution of sodium fluoride with 3 per cent. sugar. Numerous flies, including females with immature eggs, were attracted, fed for a long time on the bait, and were killed. Bait two or three weeks old (dipped again after 10 days) had not lost its effectiveness, and such a highly concentrated poison solution is not readily washed away by rain. This method is being adopted voluntarily by many onion growers in 1929.

HAHMANN (C.). **Japanische Heuschrecken und Tausendfüsse im Gewächshaus, sowie ein Versuch ihrer Bekämpfung mit Cyanogas.** [*Tachycines asynamorus* and Millepedes in Greenhouses, and an Experiment with Cyanogas against them.]—*Z. Pfl Krankh.*, xxxix, no. 2. pp. 97–112. Stuttgart, February 1929.

In 1928 attention was drawn to the Tettigoniid, *Tachycines asynamorus*, Adel., and the millepede, *Polydesmus complanatus*, L., as probably responsible for injury to cactus and other plants in greenhouses near Hamburg. Careful observations show that the grasshoppers are quite harmless and may indeed be regarded as beneficial in destroying many minute insects found in greenhouses. The millepedes attack only injured or damaged plants. They are readily captured with baits of sliced potato or carrot. Cyanogas calcium cyanide used at the rate of 1 gram per cubic metre ensures 100 per cent. mortality of *P. complanatus* with a humidity of 70 per cent. and a temperature of 13–20° C. [55·4–68° F.]. To destroy *T. asynamorus*, a dose of 3 grams per cubic metre was required, and this injures many of the plants.

ESCHERICH (K.). **Einige Notizen über die Lebensweise, wirtschaftliche Bedeutung und Bekämpfung der Blattschneiderameisen** (*Atta*). [Notes on the Life-history, economic Importance and Control of the Leaf-cutting Ants.]—*Zool. Anz.*, lxxxii, pp. 185–197, 6 figs. Leipzig, 1929.

A somewhat popular account is given of leaf-cutting ants, chiefly species of *Atta*, which are among the most serious pests in Brazil, the annual loss caused by them in the State of S. Paulo alone being estimated at £2,000,000.

BONDAR (G.). **Broca das hastes dos feijões *Zurus aurivillianus*, Hllr.** [The Bean Stem Borer, *Z. aurivillianus*.]—*Chacaras e Quintaes*, xxxix, no. 3, p. 254, 1 fig. S. Paulo, 15th March 1929.

The weevil, *Zurus aurivillianus*, Hllr., is a serious pest of beans in Brazil and has been observed in *Phaseolus lunatus*, *Dolichos* sp. and indigenous species of *Canavalia*. The larvae bore in the stems, preferably in the older ones, the mines being about $\frac{1}{10}$ inch in diameter by $\frac{3}{8}$ inch in length. There may be several larvae making parallel mines, with the result that the stem withers. Old bean plants should be uprooted and burnt. The bean pods, in which the adults feed and oviposit, may be poisoned with a liquid or dust arsenical.

Bondar (G.). **Relatorios das viagens.** [Reports on Journeys to various Districts.]—*Bol. Lab. Path. veg.*, no. 6 (1928), pp. 1–64, 21 figs. Bahia, 1929.

In the State of S. Paulo the loss caused to coffee by the coffee-berry borer, *Stephanoderes hampei*, was reduced to 5 or even 2 per cent. in 1926 [*R.A.E.*, A, xv, 30] in those plantations where control measures were applied, though elsewhere losses of 60–80 per cent. occurred.

In Bahia tobacco is attacked by *Collabismodes tabaci, Phthorimaea operculella, Engytatus notatus, E. geniculatus, Epitrix parvula* and *E. cucumeris*. In one cotton plantation, started in 1924, the losses from insect pests amounted to at least 80 per cent., the principal ones being *Gasterocercodes gossypii* and *Platyedra gossypiella*.

Bondar (G.). **Pragas da lavoura.** [Agricultural Pests.]—*Bol. Lab. Path. veg.*, no. 6 (1928), pp. 65–149, 27 figs. Bahia, 1929.

This is a collection of papers on the insect pests that occur in the State of Bahia, which have already been noticed separately in this *Review*.

Zacher (F.). **Beiträge zur Messingkäferfrage.** [Contributions to the Question of *Niptus hololeucus*.]—*Anz. Schädlingsk.*, v, no. 3, pp. 29–37, 7 figs., 92 refs. Berlin, 15th March 1929.

This review of the existing knowledge of the Ptinid, *Niptus hololeucus*, Fald., deals with its distribution, biology and control.

Sprengel (L.). *Hoplocampa flava* **L., als Pflaumenschädling.** [*H. flava* as a Pest of Plums.]—*Anz. Schädlingsk.*, v, no. 3, p. 38. Berlin, 15th March 1929.

Though the sawfly, *Hoplocampa fulvicornis*, Panz., has been considered responsible for serious injury to plums in the Palatinate [*R.A.E.*, A, xvii, 333], it has now been found that another species, *H. flava*, L., is also concerned.

Stellwaag (F.). **Ueber die Wirksamkeit von Nikotin.** [On the Action of Nicotine.]—*Anz. Schädlingsk.*, v, no. 3, pp. 38–39. Berlin, 15th March 1929.

Investigations on the pharmacological effect of nicotine insecticides on the larvae of the vine-moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] in Germany showed that the effect of the poison is typically a paralysis of the nerves. None of the various preparations acted as a corrosive poison. Most cases of poisoning occurred when the poison was taken by the mouth, pure nicotine sulphate being the most active constituent of the insecticides tested. The small doses used in viticulture, however, only give poor results without a carrier, the best being a neutral or slightly alkaline soap, at the rate of 2 per thousand. Nicotine-soap acts rapidly through the mouth and quite as rapidly through the spiracles. A lime and copper sulphate mixture rapidly liberates the nicotine from nicotine sulphate, and therefore can produce the full effect of nicotine soft-soap only under favourable conditions. The practical conclusion is that tobacco extracts should contain as little free nicotine as possible, and that they should be used with the stated amount of soft soap.

Deckert (—). **Hausbockbekämpfung in Dänemark.** [Work against *Hylotrupes bajulus* in Denmark.]—*Anz. Schädlingsk.*, v, no. 3, p. 39. Berlin, 15th March 1929.

In Denmark Storch-Jensen recently discovered that the Clerid, *Opilo domesticus*, Sturm, is an enemy of the Cerambycid, *Hylotrupes bajulus*, L., of which it eats the larvae, and experiments are to be made in breeding it in order to control the latter. At the present time fumigation with hydrocyanic acid gas is considered to be the best measure. Spraying or painting infested rafters with carbolineum is useless.

Torka (V.). **Parasiten der Kohlschabe** (*Plutella maculipennis* **Crt.).** [Parasites of the Cabbage Moth.]—*Anz. Schädlingsk.*, v, no. 3, p. 39. Berlin, 15th March 1929.

In July 1928 *Plutella maculipennis*, Curt., was very abundant in Silesia, cabbages and cauliflowers being seriously damaged. Pupation began towards the end of July.

The parasites bred included *Angitia chrysosticta*, Gmel., and *A. fenestralis*, Holmgr., the latter being probably only a colour variety of the former; *Diadromus subtilicornis*, Grav.; *Thyraeella collaris*, Grav.; *T. collaris* var. *brischkei*, Berth.; and *Exochus erythronotus*, Grav.

Cobb (N. A.). **The Chromatropism of** *Mermis subnigrescens*, **a Nemic Parasite of Grasshoppers.**—*J. Wash. Acad. Sci.*, xix, no. 8, pp. 159–166, 1 fig., 2 refs. Baltimore, Md., 19th April 1929.

This Nematode oviposits on grasses at about the same elevation as that at which grasshoppers feed and is parasitic upon them.

Fawcett (H. S.). *Nematospora* **on Pomegranates, Citrus and Cotton in California.**—*Phytopathology*, xix, no. 5, pp. 479–482, 1 fig., 14 refs. Lancaster, Pa., May 1929.

The Coreid, *Leptoglossus zonatus*, Dallas, has been found to carry *Nematospora* from pomegranate to *Citrus*. Immature fruit, when punctured by the bugs carrying the fungus, begins to colour prematurely and drops from the trees. In young cotton bolls the seeds are discoloured, and the interior becomes brown and dry. The disease was readily transmitted by transferring *L. zonatus* from infected pomegranates to sound oranges and lemons. The symptoms developed in 2–3 weeks. Attempts to isolate the fungus from the mouth-parts of the bugs were unsuccessful, though *Aspergillus niger*, which was also being carried from pomegranates to *Citrus*, was readily isolated from them. Nor could spores of *Nematospora* be distinguished microscopically on the insects, though those of *Aspergillus* were easily identified.

Knight (H.). **A Micro-technique for observing Oil Penetration in Citrus Leaves after spraying.**—*Science*, lxviii, no. 1771, p. 572, 1 ref. New York, N.Y., 7th December 1928.

The rapidly increasing use of white oil of high viscosity in sprays against scale insects on *Citrus* has been followed in many instances by injurious results. Details are here given of the technique employed

in a microscopic study of the penetration and disposition of oil within the plant tissues. Oils of high viscosity choke the vascular system for an indefinite time, the degree of obstruction depending on the amount of oil.

Insect Pests of Sugar Cane (including Utilisation of Parasites).—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 57–62. Havana, Cuba Sugar Club, 1927.

At a preliminary meeting of the committee for the section on insect pests of sugar-cane, a general discussion of the borers that occur in different regions took place. In Louisiana, it is estimated that a loss of 19 or 20 per cent. of the full crop, rising occasionally to 30 per cent., must be allowed for on account of *Diatraea saccharalis*. Four or five generations occur, varying in duration from 45 days to considerably more. Hawaii is ideally situated for the introduction of parasites and biological methods of control, but conditions in Louisiana are excellent for artificial remedies, and it is thought that by eliminating heavy grasses, by cutting the cane with a machine that will avoid leaving tall stubble in which the larvae can hibernate, and by treating seed cane to destroy hibernating borers, the pest can be controlled in that State. The water treatments of seed cane are discussed, soaking for 72 hours not only killing all borers but stimulating germination. The various factors influencing borer abundance are pointed out [*R.A.E.*, A, xv, 186]. In Java, *D. venosata* (*striatalis*) is an important borer. It is suggested that the best remedy is maximum agricultural production, particularly with varieties producing a large number of shoots. A minimum infestation of 20 per cent. is always present. In Tucumán, Argentina, the older shoots are attacked by the borer [*D. saccharalis*], leaving the later developing shoots to produce the crop, thus reducing an already short period for the growth of the cane. The opinion is expressed that deep planting is a solution of the borer problem in the tropics. In Cuba, the question of clean seed cane is of minor importance, since one planting there may last for twenty years. The resistance of different varieties of cane to borer attack is discussed. Java cane, with a strong root system and stooling habit, has the leaves pressed together at the spindle, and this apparently renders that variety more resistant to the larvae. In Porto Rico, infestation is inversely proportional to the rainfall. In the southern tropical section of Mexico, where heavy rains occur during the summer months, *D. saccharalis* is not a very serious problem; whereas, on the west coast, where cane is grown under irrigation, its winter growth is slow and the rainfall is uncertain, borer injury is much more severe. The borer in this case is *D. lineolata*, which is frequently associated with a smaller species, *Chilo loftini*. Other food-plants recorded for sugar-cane borers include maize, sorghum, broom corn, Johnson grass and rice. The plantation practices recommended in Louisiana are discussed. Other measures are dealt with in further detail in the following papers.

Plank (H. K.). **Cutting out Dead Hearts in Moth Stalkborer Control.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 62–63. Havana, Cuba Sugar Club, 1927.

On many badly infested plantations in the British West Indies, the dead hearts of sugar-cane are removed in order to destroy the

larvae of *Diatraea* in them, and the operation is repeated once or twice at about a month's interval, labour being cheap and plentiful. Experiments in Cuba have shown that it is quite impossible, with the labour available, to get all infested stalks cut low enough to remove the borers with them, though it was found that two cuttings reduced the infestation by about 50 per cent. The degree of parasitism fell proportionately with the removal of the dead hearts bearing parasites in the absence of any provision for recovering them and returning them to the fields.

Woolman (C. E.). **Dusting Crops by Airplane for Control of Insects.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 63–66. Havana, Cuba Sugar Club, 1927.

The use of aeroplanes for the distribution of insecticides, which was first adopted in 1924, is briefly reviewed. The advantages of this method and the modifications in the structure of the aeroplane and its method of flight during operations are discussed. The work is gaining headway, and fresh uses for the agricultural aeroplane are being found almost daily.

Holloway (T. E.). **Parasites of the Moth Stalkborer.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 67–68. Havana, Cuba Sugar Club, 1927.

In Louisiana, although *Trichogramma minutum*, Riley, the egg-parasite of the sugar-cane moth stalkborer [*Diatraea saccharalis*, F.] is present, it was thought desirable to introduce a parasite of the larva, and the Cuban Tachinid, *Lixophaga diatraeae*, Towns., was released on about 40 plantations, having subsequently been observed on about 80 per cent. of them. Though the borer has been continuously attacked by this parasite, control has not been effected, probably on account of the cold winter and long dormant season when no cane is above ground and borers are not present. The experiment of introducing *Ceromasia sphenophori*. Vill., a parasite of the weevil borer [*Rhabdocnemis obscura*, Boisd.], from Hawaii was tried, but, as was expected, it failed to attack *Diatraea*. *Microbracon* (*Habrobracon*) *brevicornis*, Wesm., a parasite of the European corn borer [*Pyrausta nubilalis*, Hb.], attacked the larvae readily when offered to it, but was unable to reach them in the stalks. It is hoped to introduce the Cuban parasites, *Bassus stigmaterus*, Cress., and *Apanteles diatraeae*, Mues.

Plank (H. K.). **Cuban Parasites of the Moth Stalkborer.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 68–69. Havana, Cuba Sugar Club, 1927.

In Cuba, the commonest parasite of *Diatraea* [*saccharalis*, F.] is the Tachinid, *Lixophaga* (*Euzenilliopsis*) *diatraeae*, Towns., the parasitism sometimes reaching as high as 15 per cent. Next in importance is the Braconid, *Bassus stigmaterus*, Cress.; in one observation, during May to November, 7 per cent. of parasitism by this species took place, but no parasites were taken in fifth ratoon cane. A species of *Microgaster* was abundant in late September and early October and parasitised about one-fourth of the borer larvae in some places. A Sarcophagid parasite, probably *Sarcophaga sternodontis*, Towns., was reared from pupae of *Diatraea* in April and October, but does not seem very numerous. A fungus, *Cordyceps barberi*, found in May and June, probably kills a few

borers and pupae. The variation in parasitism by these species in a season is discussed. It was noticed in the course of dusting work that *L. diatraeae* was more abundant in cane dusted with calcium arsenate than in that treated with sodium or calcium fluosilicate, probably partly because the latter were more effective in reducing the numbers of the borer.

Crawley (J. T.). **The Losses from the Sugar Cane Moth Borer in Cuba.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 69–71. Havana, Cuba Sugar Club, 1927.

Particulars are given of the losses on one sugar plantation in Cuba in consequence of the attacks of *Diatraea* [*saccharalis*, F.]. Of all the cane examined, 17 per cent. had been damaged by the borer, and the loss was roughly 2 per cent. of the yield. The author disagrees with the view that *Diatraea* is of little economic significance in Cuba. In the course of two years, it was found that in six out of eight Cuban plantations under observation, infestation was between 15 and 30 per cent.; in one estate of 1,000 acres, the loss was at least 16,000 tons of cane in one year, and in some large fields the crop was too badly damaged to be worth harvesting. The remedy suggested is co-operation amongst growers, particularly with a view to propagation of parasites.

Plank (H. K.). **Some Grasses that harbour the Sugar-cane Moth Stalkborer in Cuba.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 71–72. Havana, Cuba Sugar Club, 1927.

In the course of one summer, larvae which in character and appearance seem to be identical with *Diatraea* [*saccharalis*, F.] were found infesting six species of grass growing in or near Cuban cane fields. The most heavily attacked was *Valota insularis*, in which the infestation sometimes reached 77 per cent. *Leptochloa virgata* was less heavily infested, and *Echinocloa colonum* and *Eleusine indica* were only attacked near the mill by moths emerging from cane. *Tricholaena rosea*, which is very common along railroads and the strips between cane fields, has rarely been found infested, but *Andropogon schoenanthus*, which is grown for ornamental and medicinal purposes, harbours the borer to a considerable extent. These grasses should be eliminated as far as possible from the cane fields and their borders.

Agee (H. P.). **Work with Parasites of Sugar Cane Insects in Hawaii.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 72–74. Havana, Cuba Sugar Club, 1927.

The work done in biological control of the major pests of sugar-cane in Hawaii, namely, leafhoppers [*Perkinsiella saccharicida*], the cane borer, *Rhabdocnemis obscura*, and the beetle, *Anomala orientalis*, is briefly reviewed.

Swezey (O. H.). **Memorandum on Exploration Trips by Entomologists of the Hawaiian Sugar Planters' Experiment Station for the Purpose of discovering and introducing Beneficial Insects.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 74–75. Havana, Cuba Sugar Club, 1927.

Details are given of the dates and purpose of the journeys made by various entomologists, since the inception of the Department of

Entomology of the Hawaiian Sugar Planters' Experiment Station in 1904, in the search for beneficial insects to control sugar-cane pests in Hawaii.

Box (H. E.). **Plan for a Cooperative International Organisation for Parasite Introductions.**—*Proc. 2nd Conf. Internat. Sugar Cane Technol.*, pp. 76–78. Havana, Cuba Sugar Club, 1927.

In spite of all that has been done towards control of the sugar-cane moth borers, *Diatraea* spp., it is estimated that the annual loss from these pests is not less than £2,000,000 for North, Central and South America and the West Indies. In this paper the author amplifies his suggestions for local entomological stations for the study of parasites of these pests and their introduction where required [*R.A.E.*, A, xiv, 548], and suggests that the Braconid, *Ipobracon grenadensis*, Ashm. (*Iphiaulax medianus*, Cam.), which is the most valuable enemy of *Diatraea* in Venezuela and has recently been introduced into Argentina, might with advantage be tried in Cuba.

Ishida (M.). **Parasites introduced into Formosa for Insect Pests of Sugar Cane.**—*Proc. 2nd Conf. Internat. Soc. Sugar Cane Technol.*, pp. 78–79. Havana, Cuba Sugar Club, 1927.

The introductions into Formosa of beneficial insects from Java for the control of the moth borers, *Diatraea venosata*, Wlk. (*striatalis*, Sn.), *Chilo infuscatellus*, Sn., and *Scirpophaga nivella*, F. (*auriflua*, Zell.), since 1915 are briefly reviewed. They include *Phanurus beneficiens*, Zehnt., attacking *Diatraea* and *Chilo*, *P. beneficiens* var. *elongatus*, Ishida, attacking *Scirpophaga*, and *Diatraeophaga striatalis*, Towns., attacking *Diatraea*. *Encarsia flavoscutellum*, Zehnt., from Java, and *Coelophora biplagiata*, Swartz, and a species of *Scymnus* from Indo-China were introduced against the sugar-cane Aphid, *Oregma lanigera*, Zehnt.

Sugar Cane Diseases.—*Proc. 2nd Conf. Internat. Sugar Cane Technol.*, pp. 79–115. Havana, Cuba Sugar Club, 1927.

Among the speakers at the general session of this conference, E. W. Brandes remarked that in his opinion the theory that weeding causes the spread of mosaic disease in sugar-cane has been over-emphasised. Very few of the Aphids that have been living on grasses ever reach sugar-cane when the grass is cut down; most of them remain on the grass and die with it. *Aphis maidis*, Fitch, has been found in abundance on sugar-cane in fields that were never weeded, so that its presence there cannot be the result of deprivation of other food-plants. The results of van Breemen's experiments [*R.A.E.*, A, xvi, 128, 129] lead to the conclusion that *A. maidis* is responsible for the majority of secondary infections under natural conditions. The speaker's observations showed that colonies of *A. maidis* may be found on fairly large cane, though they apparently prefer young plants. Experience has shown the advisability of cutting and planting seed cane in the dry season, though a certain proportion of plants affected with mosaic must be expected at all seasons.

A short account of corn stripe disease on maize in Cuba, which has previously been dealt with at greater length [*R.A.E.*, A, xvii, 420], is contributed by C. F. Stahl. H. H. Storey, in the course of his studies on the virus diseases of Gramineae, found two separate strains of mosaic disease, only one of which affects sugar-cane, and two strains of streak disease, which have been described in greater detail elsewhere [*R.A.E.*, A, xii, 468; xiii, 393; xv, 345]. Considerable discussion is assigned to the question of the advisability of roguing as a control for mosaic disease. P. J. van Breemen is quoted from an earlier paper [*R.A.E.*, A, xiv, 592] as suggesting that *A. maidis* may have a period of active migration and another period when this is reduced or stopped entirely, and F. S. Earle as remarking that not only is the rapidly growing plant more susceptible in the spring, but the insect vectors are also more abundant at that time. J. Alfaro, from experiments in Cuba, the results of which are tabulated, considered that although the roguing of infected shoots is a useful measure, it is uneconomical when done to a great extent. He suggested careful selection of seed cane from healthy canefields, discontinuance of spring plantings and reliance on winter plantings only.

Dr. Brandes, continuing the discussion, remarked that, though he was open to conviction as to whether there are other means of natural dissemination than *A. maidis*, increased knowledge of the habits and migrations of this Aphid seem adequate to explain the rapid spread of the disease. He had himself observed a flight migration of *A. maidis* for two miles from the shore of a lake in southern Florida. The relationship between weather conditions, development of food-plants of *A. maidis* (including wild grasses) and the fluctuations in numbers of the Aphid is a complicated one, but considerable light has been shed upon it in recent years. Already more than one strain of mosaic has been found in the Gramineae, and distinct strains may also occur in sugar-cane. In Dr. Brandes' opinion, the maize disease reported by Stahl, transmitted by *Peregrinus maidis*, Ashm., is in all probability identical with the one found in Hawaii, and it would be disastrous if this Hawaiian disease were introduced into the United States, as *P. maidis* is widely distributed in the maize belt. The resistance of the different varieties of sugar-cane to disease is discussed. The method of feeding of *Aphis maidis* and the probable manner of infection of the cane is explained. It is probably the excretion that pours from the tip of the setae bundle as it advances through and between the leaf cells that is the actual medium by which the virus is introduced into the plant, and the mosaic organism may find a favourable medium in the food elaborated in the leaf, being rapidly transported to all parts of the plant through the phloem.

Greene (C. T.). **Characters of the Larvae and Pupae of certain Fruit Flies.**—*J. Agric. Res.*, xxxviii, no. 9, pp. 489–504, 6 figs. Washington, D.C., 1st May 1929.

The distinguishing characters of the larvae and pupae of some of the more important native and exotic species of fruit-flies represented in the United States National Museum are described, and keys are given to both larvae and pupae of the species dealt with. These are *Toxotrypana curvicauda*, Gerst., *Dacus* (*Bactrocera*) *cucurbitae*, Coq., *D. oleae*, Gmel., *Ceratitis capitata*, Wied., *Rhagoletis cingulata*, Lw., *R. pomonella*, Walsh, *Anastrepha ludens*, Lw., *A. fraterculus*, Wied., *A. striata*, Schin., and *A. serpentina*, Wied.

COLLISON (R. C.), HARLAN (J. D.) & STREETER (L. R.). **High-Nicotine Tobacco.**—*Bull. New York Agric. Expt. Sta.*, no. 562, 20 pp. Geneva, N.Y., January 1929.

Experiments in growing tobacco with a high nicotine content (*Nicotiana rustica* and *N. tabacum*) in New York for the purpose of insect control are described in detail. These species were grown successfully, but both yield and nicotine content were far below that of the same species grown under irrigation in the arid south-western States. Full details of the method of cultivation are given, as any effort to grow and manufacture tobacco for the purpose of obtaining a larger and cheaper supply of commercial nicotine should be encouraged.

MARCUS (B. A.). **Beiträge zur Anatomie und Biologie des Messingkäfers (*Niptus hololeucus* Fald.).** [Contributions to the Anatomy and Biology of *N. hololeucus*.]—*Z. angew. Ent.*, xiv, no. 3, pp. 417–449, 18 figs., 25 refs. Berlin, 1929.

The Ptinid, *Niptus hololeucus*, Fald., has been common in various parts of Central Europe in recent years. The results are here given of a study of it, undertaken with breeding material obtained in Munich in April 1928. The intestinal tracts of the adult and larva and the genitalia of both sexes are described, with particulars of the biology of reproduction and of the larval, pupal and adult stages. The life-cycle is longer than hitherto believed. On an average, the egg stage occupies 16 days; the larval feeding period, 60; that of pupal case construction, 30; the pupal stage, 18; the adult resting period (in the pupal case), 23; and the adult maturity feeding period, 25. The total therefore averages 172 days, so that 2 generations a year occur in Germany. About 25–30 eggs are laid. Oviposition extends over 3–5 weeks, or much longer if food is scarce. The beetle often finds optimum conditions in false ceilings, which are generally filled with corn chaff or similar organic substances. Damage by the larvae is negligible. Neither adult nor larva can feed on sound or rotten timber, other insects, chiefly Anobiid beetles, being responsible for injury often ascribed to *N. hololeucus*. Cases of actual damage do, however, occur in goods such as textiles, especially hosiery, and in books and papers stored for long periods. Slight infestations in dry houses can be dealt with by trapping the beetles in damp rags. In damp houses a bait might be tried. The best measure against a severe infestation is the elimination of the larval breeding-places, and this is preferable to fumigation.

VON LENGERKEN (H.). **Zur Biologie und Schadwirkung von *Ptinus tectus* Boield.** [On the Biology and Injuriousness of *P. tectus*.]—*Z. angew. Ent.*, xiv, no. 3, pp. 450–460, 8 figs., 17 refs. Berlin, 1929.

The information given here is substantially the same as that in another paper already noticed [*R.A.E.*, A, xvii, 428.]

Saupe (R.). **Zur Kenntnis der Lebensweise der Riesenschabe** *Blabera fusca* **Brunner und der Gewächshausschabe** *Pycnoscelus surinamensis* **L.** [On the Knowledge of the Life-histories of the Giant Cockroach, *B. fusca*, and of the Greenhouse Cockroach, *P. surinamensis*.]—*Z. angew. Ent.*, xiv, no. 3, pp. 461–500, 15 figs., 25 refs. Berlin, 1929.

The morphology of the adult, larva and pupa of *Blabera fusca*, Brunner, is described. It is a nocturnal insect that shelters by day in dark, warm and moderately moist places. The larvae hide under moss or turf, being apparently more sensitive to light than the adults. Fruits and leafy parts of plants are preferred as food, though animal food is also eaten and cannibalism occurs. This cockroach is ovoviviparous, and there appear to be 9 larval stages. At temperatures of 20–25° C. [68–77° F.] in moderately moist places with suitable food, development lasts about a year. The larvae consume large quantitites of food and can do much harm if present in numbers. Damage by the adults seems less important.

P. surinamensis, L., is also an imported species in Germany, and thrives at temperatures of 68-77° F. in greenhouses; the morphology of the adult, larva and pupa is described. It is nocturnal, resting by day in hollows that it makes in the ground. It can climb up glass panes and reacts to the stimulus of light even more than *B. fusca*. Like the latter, it readily eats fruit, leafy parts of plants, and bread, but refuses animal food and is not a cannibal. It is probably viviparous. The author was able to breed the larvae only up to the 4th stage, but inclines to think that there are more than 5 stages. The observed average duration of the 1st, 2nd and 3rd stage was 23, 18 and 29 days respectively. It cannot survive a temperature of 5° C. [41° F.].

van der Flaas (D. L.). **Ueber Nosematose der** *Antheraea pernyi* **Guér.** [On the Nosema Disease of *A. pernyi*.]—*Z. angew. Ent.*, xiv, no. 3, pp. 501–513, 6 figs., 16 refs. Berlin, 1929.

This paper discusses a disease due to a species of *Nosema* in the caterpillars of *Antheraea pernyi*, Guér., at the silk breeding station of Novocherkask.

Flachs (—). **Experimentell-biologische Studien an Drahtwürmern.** [Experimental biological Studies on Wireworms.]—*Z. angew. Ent.*, xiv, no. 3, pp. 514–528, 131 refs. Berlin, 1929.

Various unsuccessful attempts to deal with outbreaks of wireworms (*Agriotes obscurus*, etc.) are discussed, but the problem is considered to be as yet unsolved.

von Vietinghoff-Riesch (A. Frhr.). **Ueber das Auftreten von** *Eulia* (*Tortrix*) *politana*, **Hw., an Kiefernsämlingen.** [On the Occurrence of *T. politana* on Pine Seedlings.]—*Z. angew. Ent.*, xiv, no. 3, pp. 529–537, 9 figs., 8 refs. Berlin, 1929.

With reference to recent notes on the occurrence of a new pine pest, *Tortrix politana*, Hw. [*R.A.E.*, A, xvii, 208], as a result of biological observations for two years, which are briefly described, the author states

that this species is not an important pest, as pine seedlings completely recover from its attack. Besides some Chalcids, one Ichneumonid parasite, *Pimpla alternator*, was found.

RITTER (F.). **Die in Deutschlands Waldungen aufgetretenen schädlichen Insekten. Ein Literaturnachweis für die Jahre 1449-1926.** [The Insect Pests occurring in German Forests. A List of Papers for the Years 1449–1926.]—*Z. angew. Ent.*, xiv, no. 3, pp. 540–583. Berlin, 1929.

This list of papers, which is arranged according to orders, with a further division into species, is confined to those in which the pest concerned is recognisably named.

POUTIERS (R.). **La fourmi d'Argentine.**—*Riv. scient.*, xvi, no. 1, pp. 3–13. Nice, 1929.

The morphology of *Iridomyrmex humilis*, Mayr, is given, with its geographical distribution and an account of the usual methods employed against it in France [*R.A.E.*, A, xiv, 117].

PETIT (G.). **Introduction à Madagascar de la cochenille du figuier d'Inde** (*Dactylopius coccus* **Costa**) **et ses conséquences inattendues.**—*Rev. Hist. nat.*, (1) B, x, no. 5, pp. 160–173, 14 refs. Paris, May 1929.

This is a more detailed paper on the same subject as one already noticed [*R.A.E.*, A, xvii, 351]. [The species of *Opuntia* called by this author *O. vulgaris* is probably *O. monacantha*, on which the cochineal insect feeds in Mauritius, *cf. R.A.E.*, A, xvii, 419.]

PETRI (L.). **Rassegna dei casi fitopatologici osservati nel 1928.** [Survey of Phytopathological Cases observed in 1928.]—*Boll. R. Staz. Pat. Veg.*, ix, no. 1, pp. 1–66, 2 figs. Rome, 1929.

Many of the insect pests mentioned in this report have been noticed in the previous one [*R.A.E.*, A, xvi, 472]. Others include the vine pests, *Sinoxylon perforans*, Schr., mining in the stems; the larvae of *Cebrio dubius*, Rossi, injuring the tender shoots of graftings; *Pulvinaria vitis*, L.; *Pseudococcus vitis*, Nied.; *Phylloxera vastatrix*, Planch.; *Rhizoglyphus echinopus*, F. & R., the injuries made by which enable *P. vastatrix* to reach the deep layers of the bark of the main roots; and *Eriophyes vitis*, Nal., attacking the leaves.

Saissetia oleae, Bern., infests olive, causing the fruits to wither by puncturing the twigs and peduncles. Observations on the effect of the punctures on the tissues are recorded at some length. *Scolytus* (*Eccoptogaster*) *mali*, Bech., and *Parlatoria oleae*, Colv., occurred on apple; *Malacosoma neustria*, L., on almond; and *Anuraphis amygdali*, Buckt. (*persicae*, Boy.) on plum. *Chrysomphalus dictyospermi*, Morg., and *Toxoptera aurantii*, Boy., infested lemons. *Leucaspis pusilla*, Lw., and *L. pini*, Hartig (*candida*, Targ.) occurred on pines, and these trees near Rome were also injured by *Thaumetopoea pityocampa*, Schiff. *Galerucella luteola*, Müll., did some damage to elm. Young poplars were attacked by *Cryptorrhynchus lapathi*, L., the stems snapping at

the point of injury. Wheat pests included *Cephus pygmaeus*, L., *Sitotroga cerealella*, Oliv., *Macrosiphum granarium*, Kby., and *Chlorops taeniopus*, Mg.

TOPI (M.). **Ulteriori ricerche sulla esistenza di razze diverse della filossera della vite.** [Further Researches on the Existence of various Races of the Vine Phylloxera.]—*Boll. R. Staz. Pat. veg.*, ix, no. 1, pp. 75–92. Rome, 1929.

The experiments and observations now recorded confirm essentially the results already obtained [*R.A.E.*, A, xv, 559], namely, that no morphological distinctions of races of *Phylloxera* are possible, and that differences in the susceptibility of vines to attack do not have sufficient constancy to characterise a biological form. The conclusion arrived at in 1927 that no racial distinction based on the length of the rostral bristles is possible is further confirmed.

FAES (H.) & STAEHELIN (M.). **La lutte contre les parasites de la vigne, insectes et champignons, en 1927 et 1928.**—*Annu. agric. Suisse*, xxx, no. 1, pp. 15–36. Berne, 1929.

FAES (H.) & STAEHELIN (M.). **La lutte contre les parasites de la vigne, insectes et champignons en 1927 et 1928.**—*Prog. agric. vitic.*, xcii, no. 28, pp. 43–44. Montpellier, 14th July 1929.

In 1928, experiments were undertaken to determine the cause of the scorching frequently caused on vines in Switzerland by Bordeaux mixture both alone and in combination with Paris green. The results indicate that Bordeaux mixture when either slightly acid or slightly alkaline does not scorch either fruit or foliage, but that when it is strongly alkaline scorching is produced. The same observations apply to the combination with Paris green, the more alkaline the mixture the greater the damage resulting. The statistics confirming these statements are given in the second paper.

In 1927, the first flight of moths of *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., took place at the beginning of May, and continued with some interruptions until about 5th June. The flight of the second generation took place from 9th July until about 10th August, the maximum occurring from 19th to 27th July. The cold wet weather in August was conducive to caterpillar injury in unprotected plots. In 1928, when the weather in May and the beginning of June was wet and cold, the flight of moths was irregular, and individuals were rarely caught at the traps. The moths of the second generation, which appeared in small numbers towards the middle of July, became suddenly abundant on 18th July and disappeared about 5th August, but owing to a period of hot, dry weather many of the eggs were killed and the caterpillars in 1928 did no damage in the vineyards. From the fact that several adults of *Sparganothis* (*Tortrix*) *pilleriana*, Schiff., were caught in the traps, it would appear that this pest is again on the increase.

Numerous experiments with various insecticides were carried out against *C. ambiguella* and *P. botrana*, and the results confirmed those already obtained [*R.A.E.*, A, xvi, 169], but 3½–4 lb. calcium arsenate powder to 100 gals. Bordeaux mixture is the quantity recommended. Promising results were also obtained with a Bordeaux spray containing 2 per cent. Volck oil.

Kuijper (J.). **Verslag van het Deli Proefstation over het jaar 1928.** [Report of the Deli Experiment Station for 1928.]—*Meded. Deli Proefst.*, (2) no. 60, 62 pp. Medan, 1929.

Much of this information regarding insect pests has already been noticed [*R.A.E.*, A, xvi, 377; xvii, 54, 346]. In investigations on the biology of the tobacco Aphid, *Myzus persicae*, Sulz., it was found that breeding throughout the year was possible on *Ipomoea triloba*. Temperature is a factor of great importance in its influence on reproduction. When the daily maximum is not above 29° C. [84·2° F.], the average number of young is 50 (maximum 104), the average life of the parent being 15–16 days.

The caterpillars of *Heliothis* [*assulta*, Gn.], *Phytometra* (*Plusia*) [*signata*, F.], the small green tobacco bug, *Engytatus tenuis*, Reut. (*Dicyphus nocivus*, Fulmek), and the large green tobacco bug, *Nezara viridula*, L., injured tobacco in some localities. *Epilachna dodecastigma*, Muls., the larvae of *Gryllacris* sp., and the tobacco moth, *Setomorpha margalaestriata*, Keuch.], were also observed, vigorous measures being immediately taken against the last-named.

Kalshoven (L. G. E.). **De beschadigingen, ziekten en plagen van de djatibosschen op Java.** [Injuries, Diseases and Pests of Teak Forests in Java.]—*Tectona*, xxi, pp. 593–623, 58 refs. Buitenzorg, August 1928. (With a Summary in English.)

A short historical review is given of the various published papers on the diseases and pests of teak in Java. Apart from regular defoliations by the Noctuid, *Hyblaea puera*, Cram., from which teak recovers readily, very few pests have occurred in the past. In recent years insects injurious to the timber have attracted notice.

An annotated list of the damage in teak forests from various causes, includes that done by the following insects: the locust, *Valanga nigricornis*, Burm., attacking the leaves without, however, completely defoliating the trees; the termite, *Calotermes tectonae*, Damm.; and the Cossid, *Duomitus ceramicus*, Wlk., which mines in the trunks. The red twig borer, *Zeuzera coffeae*, Nietn., is less harmful, and has not become a definite pest of teak. The Hepialid ring-borer, *Phassus damor*, Moore, attacks the root-collar, but is rare in teak. *Lymantria obsoleta*, Wlk., *Hapalia* (*Pyrausta*) *machaeralis*, Wlk., and a Sphingid, *Marumba dyras javanica*, Butl., feed on the leaves, and *Dichochrocis punctiferalis*, Guen., infests the terminal shoots. Two Scolytids, *Xyleborus destruens*, Bldf., and *X. morigerus*, Bldf., infest this tree, and *Pseudococcus crotonis*, Green, deforms the leaves and terminal shoots of young plants.

Kalshoven (L. G. E.). **Massaal afsterven van Walikoekoenboomen door den zigzagboorder.** [Wholesale Destruction of the Tree (*Actinophora fragrans*) by a Buprestid Borer.]—*Tectona*, xxii, pp. 1–22, 8 pls. Buitenzorg, January 1929. Also in *Korte Meded. Inst. PlZiekt.*, no. 10, 22 pp., 8 pls. Buitenzorg, 1929. (With a Summary in English.)

A small Buprestid borer [which in an addendum is stated to be new to science and shortly to be described by Obenberger as *Agrilus kalshoveni*] has lately been killing large numbers of *Actinophora fragrans*, a valuable timber tree in Java. This beetle has a wide range, and even the largest trees may be killed by it. In young stands they are the first to be

attacked. Only very small saplings appear to be immune. The very slender larvae make typical zigzag galleries under the bark, and mainly subsist on the cambium and inner bark. Pupation takes place in the outer layers of the wood or in the bark. The lowest portions of the trunks, including the bases of the roots, appear to be most infested. Optimum conditions for the borer apparently occur in trees infested by neither too small nor too large a number, so that the tree dies slowly. Borers present in small numbers appear to be suffocated by the flow of sap, while large numbers cause a too rapid dying off of the tree. A Chalcid parasite has been observed, but it seems to have some difficulty in finding the borers, and its ovipositor is too short to reach larvae that pupate under bark thicker than 3½ mm. As *A. fragrans* is one of the few trees that are suitable for mixing with teak, this borer is a serious menace to forestry in the teak regions. Experiments with repellents (especially carbolineum) on uninfested trees are being made. The destruction of infested trees is recommended.

Chrystal (R. N.). **The Silver Fir Aphis**—*Mindarus abietinus*, **Koch. A new Record for Britain.**—*Trans. R. Scot. Arb. Soc.*, xxxix, pp. 49–51, 1 pl. Edinburgh, 1926. [Recd. 1929.]

Mindarus abietinus, Koch, which attacks silver fir in Denmark, is reported from this tree at Kew, and this appears to be the first record of this Aphid from Britain. Brief observations on its life-history in this country appear to agree with those of Nüsslin, which are quoted. The first effects of attack on the young twigs are seen in the twisting of the stem, the bent appearance of the needles, and the grayish-green colour of the affected shoots, which may wither, turn brown as though frost-bitten, and die. In Denmark *M. abietinus* causes deformation of the stems of silver fir and thus reduces the value of the timber for building purposes [*R.A.E.*, A, vii, 420].

Harrison (E.). **Preliminary Notes on the Control of Locusts** (*Schistocerca gregaria*).—*Bull. Dept. Agric. Kenya*, (1929) no. 3, 15 pp., 1 pl., 1 fig. Nairobi, 1929.

It is suggested that locusts (*Schistocerca gregaria*, Forsk.) do not always invade Kenya from the outside, but that they may live in the solitary form in Tanaland, the Northern Frontier Province or in Tanganyika Territory.

Experiments showed that contact spraying with a solution of 5–6 oz. of sodium arsenite to four gallons of water was most effective both against hoppers and the freshly moulted adults. Dusting with sodium arsenite by means of perforated tins was also effective. Spraying the vegetation was tried with varying success, and poisoned baits also gave good results.

The organisation improvised to deal with the 1928 invasion was not adequate considering the enormous area involved, but it is hoped that the necessity for co-operation is now realised by both planters and natives. A scheme for the organisation of future campaigns in Kenya is outlined, and estimates of the cost are given. It is considered important that the permanent breeding grounds within or near the borders of the Colony should be investigated and search made for solitary forms.

A summary of the course of the invasion up to 18th October 1928 is given.

Davidson (J.). **Report on the Occurrence of the Woolly Pear Aphis.** (*Eriosoma lanuginosum*, **Hartig ;** *E. pyricola*, **Baker and Davidson**). —*J. Dept. Agric. S. Australia*, xxxii, no. 9, pp. 798–799. Adelaide, 15th April 1929.

Further observations on *Eriosoma lanuginosum*, Htg. (*pyricola*, Bak. & Dav.) attacking the roots of nursery pear stock and pear trees in South Australia [*R.A.E.*, A, xiii, 640] revealed the presence of several nymphs of winged forms, indicating the imminent development of winged migrants. If elm trees are available, this Aphid probably overwinters in the egg stage on them. Fumigation or dipping of nursery stock and fumigation of the soil round the trees are the measures recommended for its control [*cf. R.A.E.*, A, xiv, 126].

Mellor (J. E. M.). **Bee-keeping in Palestine and Egypt compared, June, 1927.**—*Bull. Tech. Sci. Serv. Minist. Agric. Egypt*, no. 82, 17 pp., 13 pls. Cairo, 1929.

In Egypt the only pests of bees are *Galleria mellonella*, L., *Achroia grisella*, F. [*R.A.E.*, A, xvii, 173] and *Vespa orientalis*, L. [xvi, 536]. The last-named may be destroyed by blowing fine calcium cyanide powder into the opening of the nest about half an hour after sunset, when all the hornets have retired, and blocking the hole with a lump of mud.

Investigations on Cotton Insects. —*6th Rep. 1925–27, Cotton Res. Bd. Minist. Agric. Egypt*, pp. 75–83. Cairo, 1929.

Although ratoon cotton is earlier than annual cotton and attack on it by bollworms [*Platyedra gossypiella*, Saund., and *Earias insulana*, Boisd.] begins sooner, the progress of infestation is slower, and in 1925 the final percentage loss was only 13 in ratoon compared with 40 in annual cotton, the figures for 1926 being 21 and 52. There were indications that annual cotton close to ratoon cotton was more severely damaged than the rest of the annual crop. In both years ratoon crops proved far less liable to attack by *Aphis gossypii*, Glov. (cotton aphis) and *Prodenia litura*, F. (cotton leaf worm). In one locality cotton was sown in October with the idea of obtaining an early crop as free from bollworm attack as possible ; unfortunately this crop served as a breeding ground for the bollworms, particularly for *Earias*, which has no prolonged resting stage. In order to determine the relation of the date of sowing to the amount of bollworm attack, sowings were made once a fortnight from 1st February to 12th April. The earliest sowing failed to germinate. The maximum yield was obtained from the sowings of 1st and 15th March, the infestation being least in the earliest sown plots and increasing evenly with each later sowing. Abundance of water and nitrogenous manures tends to produce cotton of rank growth, and observations on 13th August showed that bollworm infestation of rank cotton was more than five times as great as in normal cotton in the vicinity, but the loss was possibly counterbalanced by the fact that the rank cotton produced in this case four more bolls per plant than the normal cotton. The method of testing the effectiveness of treatment in cotton seed for planting is to take one sample from 20 sacks, and if living larvae are found, the 20 sacks have to be heated again. In order to check this method and to test the efficiency of the machines, samples were taken in 1926–27 in small quantities from

many more sacks of treated seed in the same lot, and it was found that about 4 per cent. of living larvae were present. In 1927–28 the work appears to have been carried out with greater efficiency, as the number of living larvae only amounted to approximately 0·7 per cent. A survey to determine the number of larvae of *P. gossypiella* that survive on cotton sticks was carried out in 1926–27 for most districts of Egypt, and, as was expected, the infestation was greater in Lower than in Middle Egypt and in Middle than in Upper Egypt. As about 10 per cent. of the sticks are burned as fuel each month from November onwards and there are about 25,000 sticks per acre, the number of living larvae remaining in August is estimated at 400 per acre, but what proportion of these pupates successfully and ultimately infests the new crop is unknown. Although many thousand adults of *Prodenia litura* were caught at bait traps, only a slight benefit was noticed, and egg masses were abundant. This was probably due to the short pre-oviposition period in summer and to the fact that eggs are laid in one or a few masses instead of singly for several nights. Also the catch of moths, although large, probably only amounted to 10 per cent. of those actually present, and it is therefore evident that such traps are not of much value against this pest.

[Filip'ev (I. N.).] **Филипьев (И. Н.). [Annual Report of the] Division of Applied Entomology.** [*In Russian.*]—*Ann. Inst. Exp. Agron.*, vii, no. 1, pp. 94–106. Leningrad, 1929.

A detailed account is given of work carried out by the Entomological Division of the State Institute of Experimental Agronomy, Leningrad, for the year ending October 1928. The principal problems of the Division are discussed, and the scientific investigations made by various sub-sections on locusts and other pests and their parasites are reviewed. More detailed observations were carried out on a number of pests, the damage done by which in Russia either has not been recorded or has been inadequately described. A list of these includes: *Ceuthorrhynchus syrites*, Germ., observed on *Camelina sativa*; *Hypera* (*Phytonomus*) *pedestris*, Payk., on vetch; *H.* (*P.*) *nigrirostris*, F., *H.* (*P.*) *meles*, F., and *Cnephasia wahlbomiana* var. *virgaureana*, Tr., on clover; *Agrotis c-nigrum*, L., and *Phytomyza atricornis*, F., on flax; *Tortrix paleana*, Hb., and *Mayetiola* sp. on timothy grass; and *Asphondylia miki*, Wachtl., on lucerne and lentils. A list of publications issued by the Entomological Division and by the State Institute of Experimental Agronomy is appended.

[Shchegolev (V. N.).] **Щеголев (В. Н.). The Bud Weevil and its Control.** [*In Russian.*]—*Severo-Kavkazsk. Sadovodstvo*, i, no. 1–2, pp. 28–32, 7 figs. Rostov-on-Don, 1929.

Popular notes are given on the biology of *Sciaphobus squalidus* Gyll., which was very abundant in the northern Caucasus in 1927 and 1928. The adults and eggs are briefly described. This weevil hibernates in the adult stage in the soil near its food-plants at a depth of about 25 ins., and appears on the surface in April. Soon after emergence, the weevils infest various fruit trees, climbing along the trunk to the crown, where they first feed on swelling buds, then on young leaves, flower buds and flowers, thus considerably reducing the crop of fruit. Oviposition takes place in the first half of May; the eggs are laid in batches of 8–32 on the surface of the leaves, the edges of which

are rolled by the ovipositing females. The adults gradually die out in June. After hatching, the larvae at once drop to the ground and penetrate into the soil, where they feed on roots. Probably a period of two years is necessary for the completion of their development, though some of them become mature in one year. Sticky bands and shaking off the weevils were the most effective control measures, especially as they do not fly. The bands should be applied in early spring and always after shaking the trees. This last measure should be repeated every 7–10 days.

Spraying with lime did not protect the buds or considerably reduce the weevils.

[Fedorov (S.).] **Федоров (С.). On the Question of the Biology of the Yellow Thrips and of its Control in Cotton Fields.** [*In Russian.*]—*Khlopkovoe Delo*, viii, no. 3, pp. 291–293, 3 refs. Moscow, March 1929.

Thrips flavus, Schr., is an important pest of cotton in Turkestan, but as its biology was unknown, it was impossible to work out effective measures for its control that would be economically practicable under the conditions of that region. An attempt is, therefore, here made to give a general prognosis of the biology of this pest on the basis of a study of *Thrips tabaci*, Lind., on tobacco in the course of four years on the south coast of Crimea, as the conditions in that country and in Turkestan are similar and there exists a close biological relation between the two species.

The various stages of *T. tabaci* in the Crimea are discussed. The egg stage lasts 4–4½ days, the larval 8 days, the two nymphal stages 2½–3½ days, and the adults live 20–25 days. The insects emerge from hibernation at the end of April or beginning of May, and there are 5 or 6 generations, which usually overlap. The chief damage by both species is caused during the growing period of the foliage, but as soon as it becomes mature the insects usually abandon the plant. Consequently their occurrence is closely connected with the state of maturity of the crop. Their abundance is in direct relation to the humidity of the air.

Late in the summer and in the autumn *T. flavus* also occurs on various weeds; sometimes this also happens in early spring prior to its attacking cotton. Hibernation takes place in the soil. Lack of food, high temperature, and particularly low humidity, compel the insects to leave the plants and are fatal to the larvae of the first instar and also at the periods of hatching and moulting. The pest is consequently considerably less abundant in July, during excessive heat.

The control measures recommended, which are based on those for *T. tabaci*, comprise a rotation system in the cultivation of cotton. This should include the growing of graminaceous plants, including millet, and sowing these for two consecutive years should be very effective. Careful destruction of weeds and the removal of trash after the cotton harvest are useful supplementary measures. A single application of soap solution has only a temporary effect, as it kills the larvae and the adults on the leaves, but does not affect the eggs in the parenchyma, and the plants soon become reinfested; a second spray must, therefore, be applied after an interval of 4–5 days. Abundant irrigation, or even flooding of the cotton fields for a short time either late in the autumn or at the end of April, might also be effective.

[Arkhangel'skiĭ (P.).] **Архангельский (П.). Instructions for the Control of the Italian and the Moroccan Locusts in Uzbekistan.** [*In Russian and Uzbeg.*]—36+51 pp., 2 figs. Tashkent, Comissar. Agric. Uzbek. Rep., 1929.

Instructions are given for the organisation and technique of an anti-locust campaign by means of poisoned baits composed of 16 kg. cotton seed meal, 600 gm. sodium arsenite and 6 kg. water. Other methods, such as spraying, barriers and burning, are recommended only as subsidiary ones.

[Merzhanian (A.).] **Мержаниан (А.). The Second Conference on *Phylloxera* in Tiflis.** [*In Russian.*]—*Vestn. Vinodel. Ukrainui*, xxx, no. 4, pp. 195–197, 1 ref. Odessa, April 1929.

At this Conference, held in February 1929, the opinion that American vines are the main cause of the spread of *Phylloxera* was supported by the majority of the members, chiefly entomologists, and a resolution was passed that the use of these vines should be prohibited in the cultivation of new vineyards in uninfested regions. A protest, addressed to the State Commissariat of Agriculture, in defence of the grafting system was raised by other members of the Conference, chiefly vine-growers. The great practical importance of this method is pointed out, and attention is drawn to the fact that it helps the intensive culture of vines, increases the crop, improves the quality of the grapes and is widely adopted in France, Austria and other foreign countries as the only effective means of controlling *Phylloxera*. It makes possible the utilisation for vineyards of soils that are unsuitable for other crops and enables new types of vines better adapted to various soils and climates to be cultivated.

[Dekhtyarev (N. S.).] **Дехтярев (Н. С.). A Pest of Vines new to the Ukraine.** [*In Russian.*]—*Vestn. Vinodel. Ukrainui*, xxx, no. 4, p. 246. Odessa, April 1929.

This is a brief note on the occurrence in the Ukraine of *Polyphylla alba*, Pall., considerable numbers of which have been recorded from one district. The larvae feed on the roots of vines and other plants, and the adults are on the wing at the end of June and beginning of July.

Compton (C. C.). **Insects feeding on Truck and Garden Crops and how to control them.**—*Circ. Illinois Agric. Expt. Sta.*, no. 297, 48 pp., 16 figs. Urbana, Ill., April 1928.

In this circular, which is a revision of one already noticed [*R.A.E.*, A, xiv, 168], the control measures are brought up-to-date, several of the less important pests previously mentioned are omitted, and notes are given on *Phyllotreta vittata*, F. (striped cabbage flea-beetle), *Systena taeniata blanda*, Melsh. (pale-striped flea-beetle), *Ligyrus gibbosus*, DeG. (carrot beetle) and *Listronotus latiusculus*, Boh., and *L. rudipennis*, Blatchley (carrot weevils), which were not formerly included.

Flint (W. P.) & Chandler (S. C.). **Oriental Fruit Moth invades Illinois.** -*Circ. Illinois Agric. Expt. Sta.*, no. 338, 7 pp., 3 figs. Urbana, Ill., April 1929.

The Oriental peach moth [*Cydia molesta*, Busck], which was first found in Illinois early in the winter of 1927–28, has apparently become established in all the principal peach-growing sections of the State, although during the summer of 1928 it only caused severe damage in one of them. Brief notes are given on its life-history and control.

Cowan (F. T.) & McCampbell (S. C.). **The Mormon Cricket and its Control.**—*Circ. Colo. Ent.*, no. 53, 28 pp., 10 figs., 10 refs. Fort Collins, Colo., March 1929.

Since the outbreak in Colorado in 1922 [*R.A.E.*, A, xii, 240], *Anabrus simplex*, Hald. (mormon cricket) has spread slowly eastward and in 1927 had covered an area of over 1,000,000 acres. A description of all stages of the insect and an account of its life-history and habits are given. Although the crickets are omnivorous to a certain degree, the main part of their diet is vegetable matter ; there do not appear to be any agricultural plants that are not damaged, and many uncultivated plants and shrubs are also devoured. Their natural enemies include many birds and wild rodents, and they are readily eaten by poultry and pigs. Two insect parasites are known : the Scelionid, *Sparaison pilosum*, Ashm., which has been found in Colorado, lays its egg inside that of its host, and since the parasites develop only at high temperatures (85–95° F.), practically all their growth takes place in the following spring and summer, the delay enabling them to emerge at the time the crickets are laying their eggs ; the other parasite, the Sphegid, *Palmodes laeviventris*, Cress., which is not known in Colorado, but is fairly common in Montana, paralyses the cricket, drags it into a burrow in the soil and deposits an egg on its side. The larva feeds externally and pupates practically without changing its position. There are probably several generations of this parasite in the year. The freedom of *A. simplex* from internal parasites is probably due to its cannibal habits.

Various control measures are discussed. Cultural ones are not applicable to the large uncultivated areas infested in Colorado. The use of fire is limited by the fact that crickets seldom invade the type of land that can be readily burned over without danger or loss. Barriers to stop the hordes of migrating crickets, with pits at intervals to trap them, are very effective, but are costly, difficult to handle and require continual attention. The one of galvanised tin 8–10 ins. high used in Colorado in 1928 is probably the best, but its initial cost is high. The use of trenches with a smooth vertical surface on the inner side, into which the crickets fall and are caught in deeper holes dug at intervals or crushed by drawing a log along the ditch, is a possible means of control, though its application under field conditions in Colorado is very limited. The crickets are very erratic in their feeding, and on the whole, results from the use of poison baits have not been reliable. The following bait has been selected as the most effective : 100 lb. bran, 3 oz. amyl acetate, 5 lb. salt, 3–4 U.S. qts. liquid sodium arsenite (containing arsenic at the rate of 8 lb. to each U.S. gal.) and 11 U.S. gals. water. Experiments with various dusting and spraying materials showed that sodium arsenite was the most promising [*R.A.E.*, A,

xvi, 403], but since the sprays and undiluted dust used proved to be very expensive and caused scorching, further experiments were undertaken with sodium arsenite dust diluted with hydrated lime, in the proportions 1 : 1, 1 : 4, 1 : 8, and 1 : 12. It was found that the 1 : 4 mixture gave a higher mortality than the 1 : 8 or 1 : 12, and did not scorch the foliage. Although the 1 : 1 mixture gave 100 per cent. mortality in a short time, the foliage was scorched almost as severely as with the pure sodium arsenite dust. Further experiment showed that calcium arsenite is not only equally effective, but is cheaper and more easily procured.

In the course of the campaign in 1928 it was observed in cages that when undusted crickets came into contact with dusted individuals, the feet or antennae that formed the contact were cleaned by being pulled through the mouth, and 100 per cent. mortality was thus obtained with both dusted and undusted crickets.

In sparsely settled localities an eradication campaign is not practicable, and attention should be directed to those bands of crickets that threaten crops. A constant watch should be kept as the season advances, and when a band of migrating crickets approaches within half a mile of crops, dust should be applied immediately on the side of the band nearest the crops in the early morning or late afternoon, when the crickets are in the habit of clustering together.

In well-populated farming communities much loss of time and labour is avoided by organising a campaign. During 1928 large areas were freed from infestation in this way, and where dusting was carried out, crop losses were negligible. Early in the season the bands of young crickets were located and dusted. Later, when the crickets began to migrate, barriers and traps were used ; the bands were dusted on the side farthest from the barriers and those that were not killed by the dust were caught in the traps. The dust should be mixed in the proportion of 1 part calcium arsenite to 3 parts of hydrated lime and applied at the rate of 8 lb. to the acre ; this not only kills the insects but serves to protect crops in infested territory. Hand dust guns were generally found to be more useful than saddle guns in Colorado.

STEAR (J. R.). **The Oriental Fruit Moth in Pennsylvania.**—*Bull. Pennsylvania Dept. Agric.*, xii, no. 8 (Gen. Bull. 477), 13 pp., 7 figs. Harrisburg, Pa., 1929.

The bionomics and control of *Cydia* (*Laspeyresia*) *molesta*, Busck, are discussed, and all stages of this moth are briefly described. Laboratory experiments indicate that although lead arsenate has little effect in protecting peaches, it may be of use on apples, which are occasionally attacked.

CUTRIGHT (C. R.). **Combination Insecticide and Fungicide Sprays.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, xiv, no. 2, pp. 42–44. Wooster, Ohio, March–April 1929.

As it is sometimes necessary to apply combined insecticidal and fungicidal sprays, the mixing of dormant strength oils with liquid and dry lime-sulphur, Bordeaux mixture, and soluble sulphur and the effect

of their application on apple trees are discussed. Most oil emulsions and miscible oils are compatible with Bordeaux mixture and soluble sulphur, but if they are emulsified or stabilised with soap or ammonia, they cannot be used with liquid or dry lime-sulphur. Oils emulsified with water-soluble colloids, such as flour, milk, starches, glue, gelatin and casein, or with insoluble colloids, such as colloidal clays and Fuller's earth, can usually be mixed with lime-sulphur. Experiments show that oils with Bordeaux mixture or soluble sulphur give better and more stable mixtures than with liquid or dry lime-sulphur, and that most of the combinations may be safely used up to the time when the first leaves are $\frac{1}{4}$ in. in length.

Coad (B. R.) & Gaines (R. C.). **Poisoning the Cotton Boll Weevil.** *Leafl. U.S. Dept. Agric.*, no. 37, 4 pp. Washington, D.C., April 1929.

Brief popular instructions are given for the application of calcium arsenate dust against the cotton boll weevil [*Anthonomus grandis*, Boh.] in the cotton belt of the United States.

McDaniel (E. I.). **Borer damages Golden Glow Plants.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xi, no. 3, pp. 124–126, 2 figs., 1 ref. East Lansing, Mich., February 1929.

Owing to the superficial resemblance of *Epiblema carolinana*, Wals., which has repeatedly been bred from the roots of golden glow [*Rudbeckia*] in Michigan, to *Pyrausta nubilalis*, Hb. (European corn borer), a brief account is given of its life-history [*cf. R.A.E.*, A, xvii, 97]. Little or no injury has been attributed to this moth, the only measure of control being to destroy infested flowers and buds before the larvae are old enough to descend to the roots.

Crowley (D. J.). **Cranberry Growing in Washington.**—*Bull. Washington Agric. Expt. Sta.*, no. 230, 47 pp., 13 figs., 12 refs. Pullman, Wash., February 1929.

A brief account is given of the chief pests of cranberries as found on the Washington bogs, the more important of which have been dealt with elsewhere [*R.A.E.*, A, xii, 239 ; xiv, 67 ; xvii, 309].

Entomology.—*Ann. Rep. Iowa Agric. Expt. Sta. 1927-28*, pp. 32–33. Ames, Iowa, 1928.

Wheat pests included *Meromyza americana*, Fitch (wheat stem maggot) and *Miris dolabratus*, L. (timothy plant bug). Fields of maize were badly damaged by sod webworms and cutworms. Onions were attacked by *Hylemyia antiqua*, Mg. (*Pegomyia cepetorum*, Meade) (imported onion maggot), *Phorbia cilicrura*, Rond. (*Pegomyia fusciceps*, Zett.) (seed corn maggot), *Tritoxa flexa*, Wied. (black onion fly), *Chaetopsis aenea*, Wied. (barred-winged onion fly), and *Thrips tabaci*, Lind. (onion thrips). Seedling musk melons were so badly injured by *P. cilicrura* in one locality that over an area of 8 acres the majority of plants failed to produce any marketable fruit.

[Ritchie (A. H.).] **Control of Plant Pests and Diseases.**—*Rep. Dept. Agric. Tanganyika Terr. 1927–28*, pp. 34–40. Dar-es-Salaam [1929].

Many of the pests here recorded have been dealt with in a previous report [*R.A.E.*, A, xv, 325].

The Silk Advisory Committee has decided not to attempt the native production of silk from *Anaphe panda*, Boisd., in Bukoba, but to confine its efforts to introducing mulberry silk production. Three species of honey bee have been determined, though the domestication of African bees is very difficult. *Phaseolus radiatus* (black gram) is found to be immune to the common bean Bruchid, *Bruchus chinensis*, Thunb., and to Bruchids generally, and its hairiness protects it from the Chrysomelid, *Ootheca bennigseni*, Wse., which is very troublesome to beans during the rains, when arsenical dusting is almost impossible.

On coffee, mealybugs recently recorded include *Pseudococcus brevipes*, Ckll., *P. bukobensis*, Laing, *P. filamentosus*, Ckll., and *P. lilacinus*, Ckll. *Asterolecanium coffeae*, Newst. (yellow fringed scale) attacks coffee up to 5 years of age, the only remedy for severe infestation being uprooting and burning. Other Coccids recorded on coffee are *Aspidiotus lataniae*, Sign., *Ceroplastes vinsonioides*, Newst., *Chionaspis ritchei*, Laing, *Coccus caudatus*, Green, *Ctenochiton arborescens*, Laing, *Icerya aegyptiaca*, Doug., *Ischnaspis longirostris*, Sign., *Pseudaonidia trilobitiformis*, Green, *Pulvinaria psidii*, Mask., *Selenaspidus articulatus*, Morg., and a species of *Lecanium*, possibly new. *Coffea arabica* proved much more susceptible to Coccid attack in Bukoba than did *C. robusta*. The only known insect enemy of these Coccids is the predacious Coccinellid, *Chilocorus discoideus*, Crotch, though *Coccus* (*Lecanium*) *viridis*, Green, when numerous, was attacked by *Eublemma costimacula*, Saalm. It is hoped to introduce other predators of Coccids into Bukoba. The leaf-eating Eumolpids, *Macrocoma aurivillosa*, Marsh., and *Colasposoma coffeae*, Kolbe, were troublesome in the northern area. The worst pest of bearing coffee was the Hispid, *Dactilispa* sp. The Aphid, *Toxoptera aurantii*, Boy., occurs, but is not considered a severe pest. Minor coffee pests are *Hoplandothrips coffeae*, Bag., causing leaf-curl; *Mymarothrips ritchianus*, Bag.; *Physothrips xanthoceros*, Hood; *Retithrips aegyptiacus*, March.; and the Capsid, *Lycidocoris mimeticus*, R. & P., which causes withertip of the young growth. *Dirphya princeps*, Jord. (yellow head borer) is confined to the Bukoba coffee area. Three species of Trypetid flies occur, namely, *Trirhithrum nigerrimum*, Bezzi, var. *coffeae*, Bezzi, *Ceratitis* (*Pterandrus*) *rosa*, Karsch, and *C. capitata*, Wied. The author does not agree with the view that these maggots are not detrimental to coffee, as they induce a secondary rot of the fruit which invades the stalk and causes it to drop. *Stephanoderes hampei*, Ferr. (coffee-bean borer) now occurs east as well as west of the Great Lakes; planters in the Northern and Usambara areas, where the pest does not occur, should therefore rely on local coffee seed. The remedies against *S. hampei* are the prompt picking of mature berries, the intensive collection of all dried berries from the trees and of all fallen ones, and immediate burning of all hulls and rejected beans.

Cotton is attacked to some extent by the Coccids, *Pulvinaria jacksoni*, Newst., *Ferrisia virgata*, Ckll., *Phenacoccus iceryoides*, Green, and *Saissetia nigra*, Neitn. The parasites, *Chelonus curvimaculatus*, Cam., *Microbracon kirkpatricki*, Wlkn., and *Brachymeria olethrius*,

Waterst., have been reared from *Platyedra gossypiella*, Saund.; *M. recessus*, Szep., from *Sylepta derogata*, F.; and *Bassus aciculatus*, Brues, from *Earias* sp.

Two important pests not yet established in the Territory were intercepted during the year; these were *Pseudococcus citri*, Risso, on *Citrus* from South Africa, and *Aspidiotus harti*, Ckll., on ginger from India. A list is given of plants the seeds of which are prohibited entry without a permit, as well as others the entry of which is prohibited unless they can be inspected and treated if necessary.

Poppe (J. B.). **Principales insectos que dañan el algodón en Piura.** [The chief Insect Pests of Cotton in Piura.]—*La Vida agríc.*, vi, no. 64, pp. 283–290. Lima, April 1929.

In the Piura valley, Peru, cotton is attacked by the stainer, *Dysdercus ruficollis*, the boll-weevil, *Anthonomus vestitus*, *Gasterocercodes gossypii*, *Alabama argillacea*, *Anomis*, *Aphis gossypii*, *Jocarula agriperda* and *Heliothis virescens*. A note on *D. ruficollis* has already been published [*R.A.E.*, A, xvii, 319]. A description is given of *A. vestitus*, locally known as "picudo." Observations in July and August at temperatures of 18–25° C. [64·4–77° F.] showed that incubation required 3–5 days, that the larval stage occupied 10–15 days and the pupal, 7–10 days. Towards the end of the season the weevil does not seem to rely on the natural fall of the bolls. In many cases, after depositing from one to three eggs in the sheath, the adult cuts the peduncle supporting the boll. Two Hymenoptera oviposit in bolls and attack the larvae of this weevil. The measures advised are dusting with calcium arsenate, the destruction of old cotton plants as soon as possible after the harvest, and the adoption of a regular planting time. The results of tests with various proprietary insecticides are given.

Box (H. E.). **Sobre plagas insectiles de la caña de azúcar.** [On Insect Pests of Sugar-cane.]—*Rev. ind. agríc. Tucumán*, xix, no. 7–8, p. 212. Tucumán, 1929.

Damage to shoots of sugar-cane by the larvae of *Elasmopalpus lignosellus*, Zell., is recorded in Tucumán, Argentina. The injury resembles that by *Diatraea saccharalis*, F., but is less severe, at least 50 per cent. of the canes recovering. This moth breeds on *Echinochloa crus-galli* and will disappear from the cane-fields if this plant is removed.

Braun (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt Stade für die Zeit vom 1. April 1928 bis 31. März 1929.** [Report from 1st April 1928 to 31st March 1929 of the Stade Branch of the Imperial Biological Institute.]—*Die Landwirtschaft*, nos. 15, 16, reprint 1 p. Stade, 1929.

The section on insect pests deals chiefly with the apple sucker, *Psylla mali*, Schm. [*R.A.E.*, A, xvi, 56, 214]. In areas on the Lower Elbe where spraying with carbolineum was not practised, the apple trees were infested to such an extent as to convince the growers of the value of this treatment. Experiments with bands against *Anthonomus pomorum*, L., and *Cydia pomonella*, L., showed the advisability of removing them early in October so as to preserve the beneficial insects and spiders that usually enter them later.

Speyer (W.). **Der Apfelblattsauger** *Psylla mali* **Schmidberger.** [The Apple Leaf Sucker, *P. mali*.]—*Monogr. Pflanzenschutz*, no. 1, vii + 127 pp., 59 figs., 14 pp. refs. Berlin, Julius Springer, 1929. Price, paper, *M.* 9.60.

This monograph is the result of nearly four years' study of *Psylla mali*, Schm., in the fruit-growing districts occupying some 25,000 acres around Stade on the Lower Elbe, where in 1925 it was definitely ascertained to be a most important factor in the decreased crops observed since 1900. The morphology and anatomy of all its stages are dealt with, and records of its food-plants and world-distribution are given. The information on its development is taken from the literature and from the author's records [*R.A.E.*, A, xvi, 56]. It must be present in numbers to cause appreciable injury to large apple trees. Particulars of the susceptible varieties of apple and of the birds and insects that prey on this Psyllid are given. The larvae were never found to be parasitised, but a Cecidomyiid larva infests the adult, and may be of importance in places where dry, light soil affords it favourable conditions for pupation. A full account is given of the various artificial measures applied in the Stade districts [A, xv, 415, 469, 479, 617] and in other parts of the world. An exhaustive bibliography is appended.

Ripper (W.). **Blattlausquäler.** [Tormentors of Aphids.]—*Anz. Schädlingsk.*, v, no. 4, pp. 48–51, 3 figs., 7 refs. Berlin, 15th April 1929.

An account is given of the biology of the Trombidiid mite, *Allothrombium* (*Allothrombidium*) *fuliginosum*, Herm., which infests Aphids and is common throughout Europe. The hibernated adults are predacious, attacking Aphids and other insects, but occasionally feed on vegetable matter. They live thus up to the end of June, ovipositing at the end of April or in May, the eggs being laid in heaps of 100 or more in the ground. The larvae appear early in June, and by mid-June considerable infestation of Aphids was observed in Vienna.

A list is given of the Aphids recorded as being attacked by this mite. The method of attachment is described. Young Aphids and those parasitised by several mites succumb, but older individuals survive. The larval stage of *A. fuliginosum* occupies 14–21 days. In the second half of July the larvae abandon their hosts and enter a nymphal stage in the ground. This stage lasts 3–4 weeks, and at the end of September or early in October the adult "autumn" mites are found on shrubs and trees seeking their prey. Later they hibernate in the ground at a depth of 4–8 inches. As the adults are of negligible value as enemies of Aphids, and the larvae occur only during a short period and do not materially affect the numbers of their host, they cannot be considered of much economic importance.

Blunck (H.) & Hähne (H.). **Fortschritte in der Bekämpfung von Rapskäfern mittels Fangmaschinen.** [Progress in the Control of Rape Beetles by Means of Catching Apparatus.]—*Fortschr. Landw.*, iv, no. 7, pp. 193–199, 8 figs., 5 refs. Vienna, 1st April 1929.

Improved models of various types of apparatus for catching *Meligethes* [*aeneus*, F.] and *Ceuthorrhynchus* [*assimilis*, Payk.] have

been tested in Germany. The experiments are described in detail. An improved pattern of a horse-drawn machine [*R.A.E.*, A, xii, 292], with pans containing paraffin and water instead of boards smeared with adhesive, proved the best and most practical.

FULMEK (L.). **Giftigkeitsunterschiede gebräuchlicher Arsenmittel.** [Differences in the Toxicity of Arsenical Insecticides in common Use.]—*Fortschr. Landw.*, iv, no. 7, pp. 209–212. Vienna, 1st April 1929.

During a stay of 5 years in Sumatra the author observed differences in the toxicity of various commercial arsenical insecticides on a number of caterpillars that did not agree with the percentage of arsenic in these preparations. For instance, calcium arsenate containing about 40 per cent. arsenic acid was inferior in killing power to lead arsenate with a content of about 30 per cent., and iron arsenate (39–40 per cent. arsenic acid) proved to be the least poisonous. In practice the following sequence was observed: Paris green, lead arsenate, calcium arsenate, zinc arsenate, and iron arsenate. Of these, Paris green being a copper aceto-meta-arsenite does not really belong to the arsenate series.

Feeding experiments in 1927 in Austria with the caterpillars of *Pieris brassicae* and 5 proprietary insecticides revealed similar discrepancies. Further investigations were made on the comparative behaviour of arsenites and arsenates, and on the possibility of placing various commercial arsenicals in sequence of insecticidal effect based on a previously compared arsenic content. As, however, insecticides of a given name often contain different and sometimes impure compounds, and the inert carriers in them are not always indifferent chemically or toxicologically, the tests made in 1928 were with 6 arsenites and 6 arsenates, so mixed with talc (an actual inert carrier) as to ensure for the arsenites a content of about 39 per cent. As_2O_3, and for the arsenates, about 30 per cent. As_2O_5. The insects used were adults of the beetle, *Phyllobius oblongus*, L., and caterpillars of *Notolophus* (*Orgyia*) *antiquus*, L., *Gastropacha quercifolia*, L., and *Pieris brassicae*, L. In sequence of killing power, the arsenites were those of magnesium; lead, calcium and copper, these three being bracketed together; iron; and zinc. The arsenates were those of lead, copper, calcium, magnesium, zinc, and iron. The following sequence was obtained when arsenites and arsenates were taken together: Magnesium arsenite; copper arsenite, calcium arsenite and lead arsenite, these three being bracketed together, as owing to the rapid action of arsenites the differences could not be checked by means of examinations every 24 hours; iron arsenite; lead arsenate and zinc arsenite (these two together); copper arsenate; calcium arsenate; magnesium arsenate; zinc arsenate; and iron arsenate.

The superiority of the arsenites over the arsenates is clear. The effects of the iron and zinc salts were poor as compared with those of lead, copper or magnesium, the calcium salts occupying a half-way position. Chemical analyses of these salts were then made, the percentages of "water-soluble" arsenic acid or arsenious acid being shown in a table. The resulting sequence shows a few similarities with that in the feeding tests. Magnesium arsenite occupies the first place in both sequences, and zinc arsenite the last, but iron arsenite occupies the second place instead of the last but one. The results with the arsenates were still more contradictory, and it is evident that ordinary analysis of "water-soluble" arsenic is no guide to lethal effect.

An investigation of the action on arsenicals of the intestinal juices of the caterpillars tested was then made. Buddenbrock in physiological researches [Grundriss der vergleichenden Physiologie, 3. Teil, p. 579. Berlin, 1928.] found a pH figure of 9·0–9·8 for the caterpillar of *Bombyx mori*, L., and therefore the solubility of the arsenicals (exactly as used in the feeding tests) was tested with a pH of about 9 with Glykokoll as a buffer (280 cc. distilled water, 2 cc. 10 per cent. normal NaOH, and 18 cc. Sörensen Glykokoll). The pH solubility of the arsenites was as follows: Copper, magnesium, calcium, lead, iron, and zinc. That of the arsenates was: Lead, magnesium, copper, calcium, zinc, iron. There is therefore considerable agreement between these sequences and those in the feeding experiments. Even the difference in the relative position of iron and zinc in the arsenite and arsenate series is confirmed. The highly sensitive pH method, however, requires absolutely pure products, and the carriers in commercial products are often impurities that introduce disturbing factors. The author emphasises the desirability of avoiding far-reaching conclusions from these brief tests, the results being published simply as a statement of fact.

Tempel (W.). **Saugschäden an Kakteen und ihre Verhütung.** [Injury to Cactus Plants by Sucking Insects and its Prevention.]—*Die kranke Pflanze*, vi, nos. 4–5, pp. 63–65, 85–87, 1 pl. Dresden, April–May 1929.

The commonest and most injurious mite on cactus plants in Germany is the red spider, *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst., *bimaculatus*, Harvey), of which 183 food-plants have been recorded in North America, and 90 in Germany. Sprays of lime-sulphur (with or without 1·5 per cent. tobacco extract), nicotine and soap, or linseed oil and soap are effective against it. A spray of very dilute size, which dries rapidly and suffocates the mites, may also be used.

The Coccids infesting cacti are *Diaspis echinocacti*, Bch., *Pseudococcus adonidum*, L., *P. citri*, Risso, and *Rhizoecus* (*Ripersia*) *falcifer*, Künck., the latter infesting the roots.

Nicotine sprays are effective against a bug, probably the Capsid, *Tenthecoris bicolor*, Scott, found on *Mamillaria* spp. and *Echinocactus corniger*.

Fischer (E.). **Ist für 1929 ein neues Auftreten der Kohlschabe** (*Plutella maculipennis* **Curt.) zu erwarten?** [Is a new Outbreak of the Cabbage Moth, *P. maculipennis*, to be expected in 1929?]—*Die kranke Pflanze*, vi, no. 4, pp. 66–68, 2 figs. Dresden, April 1929.

Sudden outbreaks of *Plutella maculipennis*, Curt., occurred in 1928 in Germany over a wider area than had been noticed for years. At Erfurt, where there was a loss of £25,000 to the cauliflower crop, the increase of the caterpillars in 1928 was due to the dry weather from August 1927 onwards for about a year. The few pupae or moths that had survived the winter (temperatures of − 28° C. [− 18·4° F.]) produced a first generation of larvae nearly all of which pupated as a result of warm, dry weather in June. The resultant caterpillars in July were innumerable, and the plants (which had also suffered from

the dry weather) were in places entirely destroyed. As a further outbreak may occur in 1929, the measures advocated are the removal of all cabbage débris and of weeds, especially Crucifers, and the use of light-traps [*cf. R.A.E.*, A, xvi, 151].

Hülsenberg (H.). **Betrachtungen zum Auftreten der Kohlschabe (*Plutella cruciferarum* Zell.) im Erfurter Blumenkohlanbaugebiet im Jahre 1928.** [Observations on the Occurrence of *P. maculipennis*, Curt., in the Erfurt Cauliflower District in 1928.]—*Die kranke Pflanze*, vi, no. 5, pp. 88–91, 4 refs. Dresden, May 1929.

Tests were made in August 1928 of various powder and liquid insecticides against *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) infesting cauliflowers at Erfurt. Arsenical sprays were unsatisfactory, the best results being obtained with nicotine-soap.

Schmidt (M.). **Motten- und Wicklerraupen an Obstbäumen.** [Lepidopterous Larvae infesting Fruit Trees.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 50, 6th revd. edn., 8 pp., 4 figs. Berlin, April 1929.

This circular contains a table enabling the common Lepidopterous pests of fruit trees in Germany to be recognised by the appearance of the injury they do. Brief notes are given on the more important species and their control.

Laubert (R.) & Trappmann (W.). **Krankheiten und Beschädigungen an Azaleen und Rhododendren.** [Diseases and Injuries of Azaleas and Rhododendrons.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 99–100, 8 pp., 6 figs. Berlin, April 1929.

Azaleas and rhododendrons in Germany are attacked by the whitefly, *Trialeurodes vaporariorum*, Westw., the leaf-bug, *Stephanitis oberti*, Kol., the mealybugs, *Pseudococcus adonidum*, L., *P. citri*, Risso, and *Eriococcus uvae-ursi*, L., the weevil, *Otiorrhynchus sulcatus*, F., and the moths, *Gracilaria azaleella*, Brants, and *Oxygrapha* (*Acalla*) *schalleriana*, L. Brief notes on the control of these pests are given.

Bondar (G.). **Vaquinhas dos feijões.** [Chrysomelid Pests of Beans.]—*Correio agric.*, vii, no. 3, pp. 68–70, 2 figs. Bahia, March 1929.

The Galerucid, *Neobrotica sexplagiata*, Jac., and the Halticid, *Oxygona rubidus*, Clk., are serious pests of beans in the Brazilian state of Bahia. The latter feeds on the leaves of *Canavalia ensiformis*.

Zacher (F.). **Die Speckkäfer.** [Larder Beetles.]—*Mitt. Ges. Vorratsschutz*, iv, no. 5, pp. 54–55, 1 fig.; v, nos. 1 & 3, pp. 13–16, 44–46, 1 fig. Berlin, September 1928, January & May 1929.

A general account is given of Dermestid beetles, of which *Dermestes lardarius*, L., *D. vulpinus*, F., and, more rarely, *D. frischi*, Kg., are pests in Germany. A summary of their biology and control from the literature is given. The dusting of skins and furs with pyrethrum powders is of little use. " Flit " rapidly kills the adults and larvae, but being a petroleum product, its use is limited.

PAPERS NOTICED BY TITLE ONLY.

WOLCOTT (G. N.). **Los áfidos que afectan a la industria azucarera del Peru.** [The Aphids affecting the Sugar Industry of Peru.]—*Circ. Estac. exper. agríc. Soc. nac. agrar.*, no. 12, 11 pp., 1 fig. Lima, December 1928. [See *R.A.E.*, A, xvii, 99.]

NUNBERG (M.). **Morfologja narzędzi pyszczkowych larw i chrząszczy korników.** [The Morphology of the Mouth-parts of the Larvae and Adults of Bark-beetles.]—*Polskie Pismo ent.*, vii (1928), pp. 137–173, 3 pls,. 14 refs. Lemberg, 1929. (With a Summary in German.)

HEINRICH (G.). **Beitrag zur Kenntnis der Ichneumonidenfauna der Transsylvanischen Alpen und Siebenbürgens.** [Contribution to the Knowledge of the Fauna of Ichneumonids of the Transsylvanian Alps and Siebenbürgen.]—*Polskie Pismo ent.*, vii (1928), pp. 174–179. Lemberg, 1929.

KRASUCKI (A.). **Szkodniki owadzie na plantacjach buraków cukrowych w połud.-wsch. Polsce w latach 1921-1928.** [Records of Insect Pests of Sugar-beet in south-western Poland in the Years 1921–1928.]—*Polskie Pismo ent.* vii (1928), pp. 201–206, 2 refs., Lemberg, 1929. (With a Summary in German.)

HERING (M.). **Die Blattminierer-Gattung** *Pelmatopus* **Htg. (Hym. Tenthr.).** [The Leaf-mining Genus *Pelmatopus*.]—*Z. wiss. InsektBiol.*, xxiv, no. 1–3, pp. 97–107, 12 figs., 4 refs. Berlin, 25th January 1929.

HEDICKE (H.). *Atritomellus laticeps* **n. sp. (Hym. Callicerat.), ein neuer Parasit eines eingeschleppten Rüsselkäfers.** [*A. laticeps*, sp. n., a new Parasite of an imported Weevil, the North American *Stenopelmus rufinasus*, Gyll., occurring on *Azolla filiculoides*.]—*Z. wiss. InsektBiol.*, xxiv, no. 1–3, pp. 59–61, 2 figs. Berlin, 25th January 1929.

SWEETMAN (M. D.) & PALMER (L. S.). **Insects as Test Animals in Vitamin Research. I. Vitamin Requirements of the Flour Beetle,** *Tribolium confusum* **Duval.**—*J. Biol. Chem.*, lxxvii, no. 1, pp. 33–52, 1 fig., 26 refs. Baltimore, Md., April 1928.

CARIÉ (P.). **La destruction des "** *Opuntia* **" à l'île Maurice.**—*Rev. Hist. nat.*, (1) B, x, no. 5, pp. 174–176, 2 pls. Paris, May 1929. [*Cf. R.A.E.*, A, xvii, 419.]

NEVSKY (V. P.). **The Plant Lice** [Aphids] **of Middle Asia. III.**—*Zool. Anz*, lxxxii, pp. 197–228, 10 figs. Leipzig, 1929.

BONDAR (G.). **A broca do tomateiro,** *Phyrdenus divergens* **Champ.** [The Tomato Borer, *P. divergens*, Germ.]—*Correio agric.*, vii, no. 2, pp. 37–40, 3 figs. Bahia, February 1929. [See *R.A.E.*, A, xvii, 45, 360.]

STEER (W.). **Capsidae found on the Genus** *Rubus*.—*Entomologist*, lxii, pp. 101–108, 6 refs. London, May 1929.

HEALD (F. D.), NELLER (J. R.), OVERLEY (F. L.) & others. **Arsenical Spray Residue and its Removal from Apples and Pears.**—*Bull. Washington Agric. Expt. Sta.*, no. 226, 100 pp., 16 figs., 30 refs. Pullman, Wash., May 1928. [*Cf. R.A.E.*, A, xvi, 601.]

BRÈTHES (J.). **A propósito de** *Masarygus* **Brèthes y de** *Sarcophaga caridei* **Brèthes.** [On *Masarygus* and *S. caridei*.]—*Rev. Soc. ent. argent.*, ii, no. 2, pp. 73–74. Buenos Aires, 30th December 1928. [*Masarygus* a valid genus and *S. caridei* a valid species.]

Reh (L.). **Vom Messingkäfer.** [*Niptus hololeucus.*]—*Mitt. Ges. Vorratsschutz,* v, no. 3, pp. 39–40. Berlin, May 1929.

A number of records are given of the occurrence of *Niptus hololeucus*, Fald., in Hamburg, the dates being regarded as indicating that the chief migration periods of this beetle are in mid-summer and in winter when the heating of buildings is at its height.

Vogel (R.). **Zur Naturgeschichte des Messingkäfers** (*Niptus hololeucus* **Falderm.**). [On the Biology of *N. hololeucus.*]—*Mitt. Ges. Vorratsschutz,* v, no. 3, pp. 41–44, 8 refs. Berlin, May 1929.

In the course of observations on *Niptus hololeucus*, Fald., in Würtemberg, some of these beetles were found to live for 141 days, and individuals over 115 days old laid fertile eggs. Oviposition seems to occur throughout the year, with October and November as the peak period. Adults and larvae were kept on the excreta of rats, and as the beetles are nearly always found associated with rats and mice, the droppings of these rodents must be a normal food. The mild winter of 1926–27 appears to have caused a general increase of *N. hololeucus* in Central Europe.

Bodenheimer (F. S.). **Welche Faktoren regulieren die Individuenzahl einer Insektenart in der Natur?** [What Factors regulate in Nature the Number of Individuals of an Insect Species?]—*Biol. Zbl.,* xlviii, no. 12, pp. 714–739, 29 refs. Leipzig, 1928.

In this discussion it is concluded that parasites, predators and diseases on the one hand and limitation of the feeding space on the other are of little importance in maintaining the balance of nature. Temperature and air-moisture present an optimum combination that varies for the various stages of a given species. Any departure from this optimum shortens life, and this mortality that is due to climate suffices to explain the regulation of the number of the progeny. For instance, geographical range extends from the optimum combination to that with 100 per cent. mortality. The chief advantage enjoyed by social insects is their ability to rear their progeny under optimum conditions of warmth and moisture.

Ext (—). **Die *Tipula*-Schäden des Jahres 1928 und die daraus für die kommende Vegetationsperiode zu ziehenden Lehren.** [Losses caused by Tipulids in 1928 and the Lessons to be derived from them for the coming Vegetation Period.]—*Landw. Wbl. Schles.-Holst.,* 1929, no. 13, reprint 4 pp., 1 map. Kiel, 28th March 1929.

The larvae of *Tipula* spp. injured various crops, chiefly oats, barley and beet, in Schleswig-Holstein in 1928, usually causing a total loss. The presence of the larvae can be ascertained by pouring 5¼ pints of a 12 per cent. solution of ammonium carbonate, or 3½ pints of a 4 per cent. solution of sal ammoniac, on 22 sq. ft. of ground, as these bring them to the surface. Cultural measures ensuring rapid growth, the encouragement of birds, which are most valuable natural enemies, and a poison-bait of wheat bran mixed with sodium fluosilicate or Paris green are advocated.

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Menzel (R.). **Zum Auftreten der Blattsauger** (*Psylla*). [A Note regarding the Occurrence of *Psylla mali* in Switzerland.]—*Schweiz. Z. Obst- u. Weinbau*, xxxviii, no. 10, pp. 193–195, 1 fig., 1 ref. Wädenswil, 18th May 1929.

As the apple leaf-sucker, *Psylla mali*, Schm., has been observed in some abundance on apple trees in Switzerland, attention is drawn to a recent work on this pest [*R.A.E.*, A, xvii, 484].

Krüger (G. C.). **Insetti nocivi in Cirenaica.** [Injurious Insects in Cyrenaica.]—*Agric. Cirenaica*, i, pp. 28–32. Bengasi, 1927. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 1, p. 15. Vienna, April 1929.)

In Cyrenaica, *Lixus anguinus* is a serious pest of cabbage, and *Sesamia calamistis* of cereals.

Werner (—). *Hylecoetus dermestoides*.—*Forstarchiv*, ii, pp. 329–330, 1926. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 1, p. 18. Vienna, April 1929.)

The Lymexylonid beetle, *Hylecoetus dermestoides*, L., was common in 1926 in Germany, boring in beech, oak and spruce stumps. Infested wood must be removed in winter. The mines contain a fungus, *Endomyces hylecoeti*, on which the insect feeds. The sudden abundance of *H. dermestoides* is due to an increase of this fungus in rainy years, and its abrupt disappearance to scarcity of this food in dry years.

Shull (A. F.). **The Effect of Intensity and Duration of Light and of Duration of Darkness, partly modified by Temperature, upon Wing-production in Aphids.**—*Arch. EntwMech. Org.*, cxv, no. 4–5, pp. 825–851, 9 graphs, 1 ref. Berlin, 13th June 1929.

The experiments described were carried out in an attempt to obtain a physiological explanation of the control of wing development in Aphids [*R.A.E.*, A, xvi, 372].

The percentage of winged individuals of *Macrosiphum gei*, Koch (*solanifolii*, Ashm.) produced by subjecting the wingless parents to alternate light and darkness was again found to depend on the length of the alternating periods and the ratio of one to the other; this was equally true whether the light was strong or weak, although the influence of less intense light was less marked. Little effect on wing production was produced by periods of less than 10 hours' darkness or 2 hours' light. The maximum wing production occurred with periods of 12–14 hours darkness alternating with 6–8 hours light. The effects of single exposures to light or darkness were relatively small and very irregular.

Temperature did not affect the production of winged Aphids below 20° C. [68° F.], but wing production declined when the temperature was maintained above this figure, and ceased entirely at 26° C. [78·8° F.] and above.

Since almost all males are produced by wingless females and almost all gamic females by winged ones, the control of wing production in one generation controls sex in the following generation, in so far as gamic individuals are produced in the latter generation.

MORSTATT (H.). **Die jährlichen Ernteverluste durch Pflanzenkrankheiten und Schädlinge und ihre statistische Ermittelung.** [Annual Crop Losses through Plant Diseases and Pests and their statistical Determination.]—*Ber. Landw.*, ix, no. 4, pp. 433–477, 1 map. Berlin, 1929.

The annual losses caused by insect pests in Germany are estimated at over 31 million pounds.

SPRENGEL (L.). **Versuche zur Vergiftung des einbindigen Traubenwicklers (*Clysia ambiguella* Hbn.) mit verschiedenen Arsenverbindungen.** [Experiments in poisoning *C. ambiguella* with various Compounds of Arsenic.]—*Wein u. Rebe*, x, no. 11, reprint 16 pp. [? Mainz, 1928.]

In experiments to ascertain the time required for arsenicals to check the feeding or to kill the larvae of *Clysia ambiguella*, Hb., the commercial preparations used contained calcium arsenate, copper acetate meta arsenite (Paris green), and di-plumbic and tri-plumbic arsenate, and the results are given in a series of tables. It was noticed that boring into the grapes had not occurred in all cases where the larvae were killed. In the case of larvae of the spring generation this is not surprising, because they have to fasten their webs to the berries and their mouth-parts touch the poison in doing so. Sprays acted less rapidly than dusts. Microscopic examination showed that in the case of a well-adhering dust, the various particles are close to each other, whereas the poisonous films resulting from spraying form patches of unequal area between which the surface of the berry is exposed.

HARDOUIN (R.). **Observations biologiques sur deux espèces phytophages ennemies des groseilliers.**—*Misc. Ent.*, xxxi, no. 7, pp. 61–67, 1 pl., 2 figs. Castanet-Tolosan, 1928.

The author discusses the sawfly pests of gooseberry and currants in France, with accounts of the life-history of *Pteronus ribesii*, Scop., and *Pristiphora pallipes*, Lep.

VERGUIN (J.). **Le *Popillia japonica* Newm. Ses ravages en Amérique. La menace pour l'Europe.**—*Rev. Zool. agric.*, xxviii, no. 1, pp. 1–4, 4 figs., 1 ref. Bordeaux, January 1929.

In view of the possible introduction of *Popillia japonica*, Newm., into Europe, the author briefly describes the adult, larval and pupal stages of this beetle and gives a list of its most important food-plants, confirming the views of Vayssière as to the necessity for the enforcement of the strictest measures to prevent its introduction into France or her colonies in North Africa [*cf. R.A.E.*, A, xvii, 119].

POUTIERS (R.). **Observations sur quelques Hyménoptères parasites de Coccides sur le littoral méditerranéen.**—*Rev. Path. vég. Ent. agric.*, xv, no. 9, pp. 267–270, 3 refs. Paris, November 1928.

To the author's previous list of the Hymenopterous parasites of *Chrysomphalus dictyospermi*, Morg. [*R.A.E.*, A, xii, 290], he now adds a number of others with various Coccid hosts. These include

Aspidiotiphagus citrinus, How., on *C. dictyospermi*, *Aspidiotus hederae*, Vallot, *Chionaspis euonymi*, Comst., and *C. bambusae*, Ckll. ; *Aphelinus longiclavae*, Mercet, on *A. hederae* ; *Signiphora merceti*, Malen., *Dicopus citri*, Mercet, *Aphelinus* sp., and *Allapus excisus*, Westw., on *Chionaspis euonymi* ; *Adelencyrtus aulacaspidis*, Brèthes, on *Aulacaspis rosae*, Bch. ; *Prospaltella berlesei*, How., on *A. pentagona*, Targ. ; and *Coccidencyrtus poutiersi*, Mercet, *Physcus testaceus*, Masi, and some undetermined species of *Aphelinus* on *Diaspis zamiae*, Morg.

WILLAUME (F.). **La protection des cultures fruitières en Hollande.**—*Rev. Path. vég. Ent. agric.*, xv, no. 9, pp. 271–278, 4 refs. Paris, November 1928.

As the result of a visit of several French horticulturists to various districts in Holland, the organisation and methods of working of the Dutch Phytopathological Service are described, and the control measures adopted with success in orchards and in greenhouses are discussed.

PUSSARD (R.). **Sur la destruction du Coléoptère** *Niptus hololeucus* **Fald. pullulant dans une villa aux environs de Lyon.**—*Rev. Path. vég. Ent. agric.*, xvi, no. 1, pp. 29–33. Paris, January 1929.

A case of serious infestation of a house with large numbers of *Niptus hololeucus*, Fald., is described, woollen and silk clothing in cupboards being spoiled in a few days by its attacks. The beetles had been present for some years, and in 1927–28 several hundred thousand were observed in the house. After preliminary and unsuccessful fumigations with paradichlorobenzene and sulphur, liquid chloropicrin was used at a strength of 5 cc. to every 35 cu. ft. of space, all apertures being rendered as airtight as possible. The fumigation was carried out in late June, when the adults were scarce and most of the larvae were newly hatched, the temperature averaging about 66° F. All the beetles in the house were killed by this means, and none was found even in August, the date of hatching of the second generation.

COLIZZA (C.). **Contributo alla conoscenza del balanino delle castagne** (*Balaninus elephas* : **Insecta Coleoptera**). [A Contribution to the Knowledge of *Curculio elephas* infesting Chestnuts.]—*Boll. Lab. Zool. Portici*, xxii, pp. 244–263, 8 figs. Portici, 15th May 1929.

Descriptions are given of the adult, egg, larva and pupa of *Curculio* (*Balaninus*) *elephas*, Gyll., a weevil that is a pest of chestnuts in Italy, and has also been recorded from France, Germany and Austria. It oviposits in chestnuts and acorns. In open-air breeding cages at Portici the first adults appeared in mid-July, the maximum number occurring from August to mid-September. The eggs are matured about 3–4 weeks after emergence. Feeding is not necessary for attaining sexual maturity. A female can lay about 20 eggs, and more than one is usually deposited in a single chesnut, up to 10–12 larvae having been obtained. The more larvae present, the smaller they are. They usually leave the chestnut to enter the ground in October in order to pupate, but if food is scarce, they remain in the chestnut up to the adult stage.

The adults of both sexes puncture the bases of the nuts in order to suck the juices, and if the nuts are young, they often drop. Older nuts may remain on the tree. The damage done may involve a loss of 20 per cent. of the crop.

The author was able to find only one parasite, the Braconid, *Sigalphus sculpturatus*, Szepl., which was obtained in September from the larvae of *C. elephas* in acorns. The fungus, *Metarrhizium anisopliae*, attacks the larvae, and in wet weather in spring it kills a large number.

The only practicable measure consists in collecting the chestnuts into heaps in selected places immediately after they have fallen. The larvae will then migrate to the ground, where they can be killed with injections of carbon bisulphide. In store-houses excellent results are obtained by soaking the chestnuts for 40 minutes in water at 52–54° C. [125·6–129·2° F.]. They must then be kept in cold water for some hours before being allowed to dry.

Informes sobre el estado sanitario de los cultivos en el año 1928. [Reports on the Condition of Crops in Spain in 1928.]—83 pp. Madrid, Estac. cent. Fitopat. agric., 1929.

Among the pests mentioned in this series of reports is the weevil, *Hypera* (*Phytonomus*) *variabilis*, Hbst., a pest of lucerne not previously noticed. The adults hibernate, ovipositing from the middle to the end of winter. The eggs are laid in batches of 7–30, in cavities made by the female in the stalks of lucerne and other species of *Medicago*. The young larvae feed on the parenchyma of the closed terminal leaves, remaining on the lower surface of the leaf, but later on they move to the upper surface. They pupate in webs spun among the dry leaves and other débris near the plant, and the adults emerge a week or two later.

Prays oleellus, F., did extensive damage to the olive crop around Seville. It has three generations a year, but insecticides are only effective against the larvae of the second, which attack the buds and floral clusters. It is customary to spray with lead arsenate, but the wetting power of the spray must be high. As the moths are attracted by sweetened baits, pots filled with a solution of molasses and sodium arsenate might be used. In some localities pimentos were severely attacked by Noctuids, of which *Laphygma exigua*, Hb., was the most important. Dusting with calcium arsenate was fairly satisfactory, but better results were obtained with sprays containing 1 per cent. lead arsenate.

Mokrzecki (Z.). **Strzygonia choinówka** (*Panolis flammea* **Schiff.**). **Monografija Leśno-Entomologiczna.** [*Panolis flammea*, Schiff. A Monograph of Forest Entomology.]—8vo, 131 pp., 15 figs., 2 pls., 1 map, 8 pp. refs. Warsaw, Zw. Zawod. Leśnik. Polsk., 1928.

This is a detailed account of *Panolis flammea*, Schiff., serious outbreaks of which occurred in Poland from 1922 to 1924, resulting in the defoliation of over 1,000,000 acres of pine forests. Its systematic position is discussed, and all its stages are described. Though the distribution of this moth in Europe extends from the Rhine to the Ural

mountains, the chief outbreaks occur in regions on the right bank of the Oder and in eastern Prussia; in Poland its main breeding-places are the regions south and east of Danzig and to the south-east of the Masurian lakes. The most serious outbreaks occur where the forests consist of pure stands of old pines, mixed forests being one of the factors that regulate the increase of the pest. The results of 100 years of observations in Germany show that the moths begin to increase in numbers in a year when the weather is hot and dry, and that a very severe outbreak takes place in the third year, which is followed by a sudden crisis, when their numbers rapidly decrease. The moths are most abundant in regions where the average temperature is 8° C. [46·4° F.] and the annual rainfall not more than 60 cm. [24 in.].

The bionomics of *P. flammea* are dealt with at length, and a list is given of its parasites in Poland, including, besides those already noticed [*R.A.E.*, A, xi, 454], *Coelichneumon comitator*, L., *C. bilineatus*, Gmel., *C. fuscipes*, Gmel., *Stenichneumon haesitator*, Wesm., *Cryptus dianae*, Grav., *Campoplex adjunctus*, Först., *Pimpla instigator*, F., *Ophion luteus*, L., *O. ventricosus*, Grav., *Henicospilus merdarius*, Grav., *Meniscus murinus*, Grav., *Meteorus scutellator*, Nees, *Trichogramma evanescens*, Westw. (*piniperdae*, Wolff), *Winthemia amoena*, Mg., and *Gonia fasciata*, Mg. The fungi that destroy the larvae are also discussed. Mixed forests are more favourable for the development of parasites and insectivorous birds than those consisting entirely of pines.

The characteristics and extent of the damage done to forests by *P. flammea* and the methods of controlling outbreaks are exhaustively discussed, and a special chapter is devoted to its occurrence in Poland, including a record of the course of outbreaks there at various periods, with estimates of the damage caused.

Nagel (W.). **Ueber Frassermüdung bei Raupen hervorgerufen durch Arsenpräparate.** [Disinclination to feed in Caterpillars caused by Arsenical Insecticides.]—*Anz. Schädlingsk.*, v, no. 5, pp. 55–58. Berlin, 15th May 1929.

In the course of work against the nun moth [*Lymantria monacha*, L.] in Pomerania in the summer of 1928, it was noticed that trees dusted with arsenicals remained leafy, although larvae and pupae were present in abundance, so that it appeared that the caterpillars had ceased to feed. Experiments made with various Lepidopterous larvae, using three proprietary dust insecticides containing calcium arsenate, confirmed the fact that the surviving larvae cease feeding and refuse (to a varying degree) unpoisoned food offered after three days' feeding on poisoned food. The variation in effect, which was even more marked with caterpillars of *Lasiocampa quercus*, L., than with those of the nun moth, is due to differences in the method of manufacture of the dusts used.

van Emden (F.). **Ueber die Rolle der Feuchtigkeit im Leben der Speicherschädlinge.** [On the Part played by Moisture in the Life of Warehouse Pests.]—*Anz. Schädlingsk.*, v, no. 5, pp. 58–60, 13 refs. Berlin, 15th May 1929.

The moisture content of the food of pests of stored products has received little attention, but it is often a more important factor in the

choice of food than the composition of the material. The food of phytophagous insects in the field contains generally 70–95 per cent. moisture, but among warehouse pests, though *Carpophilus* spp. feed on dried fruits with about 24–32 per cent. moisture, the majority infest far drier substances. *Sitodrepa panicea*, L., nearly always feeds on material containing 6–15 per cent. moisture. The percentages for a number of food-stuffs are shown ; the figures vary considerably in a given material. For instance, well-stored cereals contain about 6 per cent., whereas badly stored cereals often have 17 per cent. The less moisture present, the more difficult does it become for a pest to obtain a footing. If fertilised females are given heat-dried food, the progeny is small. The preference of larvae of *Ephestia kühniella*, Zell., for nut chocolate is probably due to its higher moisture content as compared with ordinary chocolate.

The bodies of pests of stored products have a higher moisture content than that of their food, and to conserve it they spin shelters, etc., to reduce the loss of perspiration moisture, and their excreta are dry. The species that are not so adapted require more moisture for development and often occur as secondary pests, so that they were formerly regarded as carnivorous. *Silvanus* (*Oryzaephilus*) *surinamensis*, L., *Laemophloeus ferrugineus*, Steph., and *Tribolium confusum*, Duv., are examples of this. It is not improbable that the moisture requirements of various pests of stored products could be utilised for preventive measures on a large scale by ascertaining the minimum amount of moisture needed to permit young larvae to establish themselves and the kind of storehouse construction ensuring the maintenance of this minimum.

VAN POETEREN (N.). **De bestrijding van den appelbloesemkever.** [Measures against the Apple Blossom Weevil.]—*Tijdschr. Plantenziekt.*, xxxv, no. 4, pp. 112–113. Wageningen, April 1929.

In giving an account of Massee's work on the control of the apple blossom weevil [*Anthonomus pomorum*, L.] [*R.A.E.*, A, xiii, 60], the author suggests that the trap-bands of sacking should be thrown into hot water to kill the weevils and not into water on which a film of paraffin is poured, as the smell of paraffin may render the sacking repellent to the weevils if it is used again.

DE KONING (M.). **Over schade door** *Strophosomus*. [On Injury by *Strophosomus*.]—*Tijdschr. Plantenziekt.*, xxxv, no. 4, pp. 114–116. Wageningen, April 1929.

The weevils, *Strophosomus obesus*, Marsh., and *S. coryli*, F., are common in Holland. The former is chiefly a pest of pine, but attacks deciduous trees as well, whereas the latter usually attacks deciduous trees, but also occurs on conifers. *S. obesus* is of more economic importance. It was observed with a third species, *S. lateralis*, Payk., in cleared ground where conifers had been the prevailing species. The information on these weevils given by Reissig is reproduced [*R.A.E.*, A, xvii, 58].

Hooper (C. H.). **The Study of the Order of Flowering and Pollination of Fruit Blossoms applied to commercial Fruit Growing.**—*J. R. Soc. Arts*, lxxvii, no. 3981, pp. 424–442. London, 8th March 1929.

This paper includes a discussion of the part played by insects in the pollination of fruit blossoms. Among the small fruits pollinated by insects are strawberries, which, however, are also pollinated by wind; raspberries and loganberries, which although perfectly self-fruitful, need insects to carry their pollen; and gooseberries and red and black currants, the pollen of which is glutinous and cannot be transported by wind, so that they are dependent on insects to carry it from the anthers to the stigmas.

Hymenoptera, owing to their structure and habit of keeping to one kind of flower on a journey, are the best fruit pollinators. Although bumble bees and small wild bees do good work, the pollination of large blocks is often beyond the capacity of local insects, so that the introduction of hives is of great value. They should be distributed rather than concentrated, one hive to an acre of fruit being an ideal arrangement. As honey bees are supposed to fly from their hives against the wind and return with it laden with pollen, it may be advisable for the hives to face the direction of the prevailing wind.

Shull (A. F.). **Determination of Types of Individuals in Aphids, Rotifers and Cladocera.**—*Biol. Rev. & Biol. Proc. Cambridge Phil. Soc.*, iv, no. 3, pp. 218–248, 5 pp. refs. Cambridge, July 1929.

This is a review of the literature dealing with the influence of various factors, including temperature, nutrition and light, on the production of sexual forms in Aphids, Rotifers and Cladocera and of winged forms in Aphids, and with the physiological processes involved.

Smith (K. M.). **Studies on Potato Virus Diseases. V. Insect Transmission of Potato Leaf-roll.**—*Ann. Appl. Biol.*, xvi, no. 2, pp. 209–229, 3 pls., 7 refs. Cambridge, May 1929.

An account is given of experiments undertaken during 1927 on the relation of insects to the virus of potato leaf-roll disease. The following insects that feed on potato were tested: *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.), *Lygus pabulinus*, L., *Eupteryx auratus*, L., *Empoasca* (*Chlorita*) *viridula*, Fall., *Macrosiphum gei*, Koch, *Myzus persicae*, Sulz., and *Psylliodes affinis*, Payk. (potato flea-beetle), but positive results were only obtained with *M. persicae*. The most satisfactory method of obtaining sprout infection was by planting half a potato tuber in a 5-inch pot with the sprouts appearing above the soil; Aphids that had fed on infected plants were then colonised on the sprouts and the whole covered with a hurricane lamp chimney, the lower rim being pushed into the soil and the top covered with muslin held in place by a rubber ring. When the requisite time for infection had elapsed, the sprouts were cleared of Aphids and the plants allowed to grow to maturity. From 24 half tubers inoculated by infective adults of *M. persicae*, 24 infected plants were obtained; and from 12 half tubers inoculated by larval forms, 10 infected plants were produced. This shows that the larvae are efficient carriers of the disease provided that they have fed on an infected plant long enough to pick up the virus. The disease first becomes visible in the young leaves, but later

the whole plant is affected. Further experiments with *M. persicae* in 1928 confirmed the results obtained in the previous year. In the glasshouse it is possible to transmit leaf-roll to a healthy plant by means of this Aphid with almost the same reliability as by grafting and in a shorter time, the incubation period of the virus in the plant averaging about 30 days.

Other experiments were carried out with a view to elucidating the relations existing between the virus and the insect. Two years' work on the question of the transmission of the virus to the progeny of infective Aphids gave negative results, and it is therefore concluded that the virus is not inherited. It was shown that two individuals of *M. persicae* (and in a few cases one) are capable of infecting a plant with leaf-roll. The colonisation of virus-bearing Aphids on non-solanaceous plants immune from the disease for periods up to 7 days did not affect their infective power, which shows that the virus is not mechanically carried by mere adherence to the external mouth-parts. Aphids from plants infected with combinations of leaf-roll and streak disease or leaf-roll and mosaic only transmitted leaf-roll to healthy potato plants, although the fact that a mottling disease was produced by these Aphids in tobacco plants, which are particularly susceptible to potato mosaic, shows that the Aphids were picking up both viruses, their separation depending on the plant rather than on the insect. Seven varieties of potato were infected with the disease by means of *M. persicae*, and no apparent difference in degree of resistance was observed. The virus may be disseminated by Aphids feeding upon the sprouts of the tuber, the leaves and shoots of the plant, or the stem alone.

MacGill (E. I.). **The Biology of Thysanoptera with Reference to the Cotton Plant. IV. The Relation between the Degree of Infestation and Surface Caking of the Soil.**—*Ann. Appl. Biol.*, xvi, no. 2, pp. 288–293, 2 figs., 2 refs. Cambridge, May 1929.

From experiments in 1926 on the influence of the water-supply of a cotton plant on the degree of infestation by *Thrips tabaci*, Lind., it was suggested that a heavy water-supply promotes surface caking of certain soils and will thus act inimically on species of Thysanoptera that pupate in the soil [*R.A.E.*, A, xvi, 149]. In this paper an account is given of experiments undertaken in 1927 to test this suggestion. Four blocks of cotton plants grown in pots were arranged at the corners of a rectangle so that the shortest distance between the groups was about 4 ft. At even shorter distances than this there is very little migration from one block to another, and any insects that migrate are usually adult thrips that have already oviposited. For this reason, and also because the adult thrips is more active than the larva, and therefore more likely to be lost during counts, the number of larvae per unit area of foliage gives a much more exact indication of the degree of infestation. In all cases the soil, a medium clay loam that easily became caked, and the quantity of water supplied were the same, but in two diagonally opposite blocks the soil was never allowed to cake, the surface being kept in a state of fine tilth to a depth of 2–3 in. The texture of the surface of the soil did not appear to affect the health of the plants. Infestation counts of thrips were made every few days and the infestation factor [*loc. cit.*] for each block was

obtained. The plants in the pots in which the surface of the soil was tilled showed a higher infestation than those in which the surface was allowed to cake, the difference in infestation factors for the two groups being largely due to differences in numbers of the larval thrips.

Edwards (E. E.). **A Survey of the Insect and other Invertebrate Fauna of Permanent Pasture and Arable Land of certain Soil Types at Aberystwyth.**—*Ann. Appl. Biol.*, xvi, no. 2, pp. 299–323, 4 figs., 19 refs. Cambridge, May 1929.

An account is given of an investigation into the insect fauna of four distinct soil types from a permanent pasture and one from an arable area that was carried out in Wales from January 1925 to February 1926. The district and the areas examined are described. Mechanical and chemical analyses were made of the soil and the flora of the four pasture types investigated. A list is given of the insects found and the fauna is discussed in relation to the types of soil and the depth of occurrence. Injurious insects occurred in the four pasture areas. The larvae of Elaterids and Curculionids were found in all, but were scarce in the alluvial area, where the soil was heavy and sometimes water-logged ; larvae of Tipulids were absent in the alluvial type, but present in the other three. Parasitism was infrequent, but a larva of *Tipula* sp. was found attacked by *Aphiochaeta brevicostalis*, Wood, a species that has previously been recorded only from dead snails. The larvae of a Cecidomyiid, probably *Oligotrophus alopecuri*, Reut., occurred gregariously near the base of the grass, *Alopecurus pratensis*, between the old sheath and the stem, but the only effect observed was the withering of the lower leaf.

Hodson (W. E. H.) & Beaumont (A.). **Fifth Annual Report of the Department of Plant Pathology for the Year ending September 30th 1928.**—*Pamph. Seale-Hayne Agric. Coll.*, no. 30, 41 pp. Newton Abbot, Devon, 1929.

The more important pests of cereals occurring in Devon and Cornwall during 1927–28, other than those mentioned in the previous report [*R.A.E.*, A, xvi, 424], included *Agriotes* spp. on wheat and oats ; *Phyllotreta vittula*, Redt., on barley ; *Lema melanopa*, L., on wheat, oats and barley ; and *Oscinella frit*, L., which attacked wheat as well as oats. Late sowings of peas and broad beans were injured by *Sitona lineata*, L., and *S. hispidula*, F. Mangels were attacked by *Pegomyia hyoscyami* var. *betae*, Curt., which was abnormally injurious in North Cornwall, *Phytometra* (*Plusia*) *gamma*, L., *Polia* (*Hadena*) *oleracea*, L., and *Smynthurus viridis*, L., which was observed in abundance feeding on the cotyledons of the young plants in South Devon. Brussels sprouts were severely injured locally by the Syrphid, *Platychirus albimanus*, F. *Anuraphis dauci*, F., was observed on carrot, and *Cavariella pastinacae*, L., caused considerable damage to young celery plants in cold frames.

Pests of fruit included *Phyllobius oblongus*, L., which injured the buds of pear extensively in early April, and *P. pyri*, L., which attacked the foliage ; *Plesiocoris rugicollis*, Fall., on apple and black currant, and for the first time on gooseberry ; the Pentatomid, *Palomena prasina*, L., and *Emphytus cinctus*, Klug, on raspberries ; *Hoplocampa testudinea*,

Klug, which was unusually abundant on apple ; *Anisopteryx aescularia*, Schiff., which infested apple and severely defoliated black currants ; *Hybernia defoliaria*, Cl., on apple ; *Cheimatobia brumata*, L., which was very abundant on apples, plums and currants ; *Phytometra gamma*, on strawberry ; *Gasteropacha quercifolia*, L., defoliating young apples ; and *Acronycta rumicis*, L., which defoliated strawberries under glass. Insects attacking ornamental plants included *Meloë violaceus*, Marsh., which destroyed anemone buds in South Devon ; the weevils, *Otiorrhynchus sulcatus*, F., on *Hydrangea* and *Cyclamen*, and *Cionus scrophulariae*, L., on *Buddleia* ; and the Coccid, *Lichtensia viburni*, Sign., on castor oil plants [*Ricinus communis*].

Lists are given of the insects recorded as causing damage to crops and miscellaneous products during the five years 1924 to 1928, and of those recorded only in 1928 or occurring on food-plants not recorded in the preceding years.

Encarsia partenopea, Masi, a parasite of *Trialeurodes vaporariorum*, Westw. (greenhouse whitefly), was observed in December 1927, when numerous adult parasites were seen to be ovipositing in healthy whitefly scales on *Salvia* in a glasshouse. The glasshouse was under gentle heat throughout the winter, but the temperature frequently fell to 40° F. during cold weather in December and January. Numbers of parasites emerged on 10th January, and two weeks later the majority of the Aleurodids were infested. In spite of this, however, they increased considerably, so that on 9th February the house was fumigated with calcium cyanide at the rate of ½ oz. to 1,000 cu. ft. of space, a dosage that scorched the plants but killed the whitefly. Large numbers of the parasites survived the fumigation, and whitefly scales found on 20th April on tomatos planted in March were heavily parasitised. The whitefly again increased rapidly, the parasite being apparently unable to breed with sufficient rapidity to obtain control, but a mixed glasshouse, which was fairly heavily infested when a few parasites were liberated in May 1928, was found in the following October to contain very few whitefly scales, 90 per cent. of which were parasitised.

Entomology. Progress Report.—*Rep. East Malling Res. Sta. 1928*, xvi, pt. 1 (general), pp. 109–111. East Malling, Kent, April 1929.

Nine proprietary tar distillate winter washes and an oil spray of known composition were tried in 1928 against the fruit-tree red spider, *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.). Four of the washes killed 60–68 per cent. of the viable eggs, but two of these caused severe bud injury and a third did not control Aphids or Lepidoptera. The other washes destroyed only 1–10 per cent., and the oil 50 per cent. A period occurs in the spring when eggs of this mite are not present or present only in limited numbers, and it is then that sprays of sulphur or potassium sulphide (liver of sulphur) should be applied to the trees to control it [see next paper].

Investigations on the relative susceptibility of cherry root stocks [*Prunus avium*] to *Myzus cerasi*, F. [*R.A.E.*, A, xvi, 582] have been extended, and a wider range of stocks, including certain varieties of sour cherries [*P. cerasus*], has been tested in the field. In 1928 all the stocks, including varieties resistant in the previous year, proved susceptible. Tests of the resistance of apple seedlings to woolly aphis

[*Eriosoma lanigerum*, Hausm.] were confined to Northern Spy crossed with Doucin II ; three of these seedlings maintained their immunity, and two others were highly resistant.

The incidence of the black currant gall-mite [*Eriophyes ribis*, Nal.] on red currants [*R.A.E.*, A, xvii, 324] becomes more serious each year, the mite having been recorded on five well-known varieties this season. The form found on red currants may be a distinct variety, as it has not been possible to induce it to colonise black currants.

MASSEE (A. M.). **The Fruit Tree Red Spider** (*Oligonychus ulmi* **C. L. Koch**).—*Rep. East Malling Res. Sta. 1928*, xvi, pt. 1 (general), pp. 116–122, 1 ref. East Malling, Kent, April 1929.

Paratetranychus pilosus, C. & F., of which the author considers *Oligonychus ulmi*, Koch, to be an earlier name, has considerably increased on fruit trees during recent years. This is considered to be due to the general and continued use of tar distillate winter washes, which either destroy or drive away hibernating insects that prey on it [see next paper], and to the consequent disuse of many of the routine sprays of sulphur and nicotine, which are toxic to mites. *P. pilosus*, which sometimes occurs in greenhouses on peach and other plants, may be distinguished from *Tetranychus telarius*, L., which is very common not only on greenhouse plants, but also on strawberries, violets and other outdoor ones, and occasionally occurs on fruit trees, by its duller colour and by the fact that it invariably passes the winter in the egg stage, *T. telarius* almost always hibernating as an adult. The latter spins a web, whereas *P. pilosus* lives freely upon the leaves.

The winter eggs are laid during late September, October and, in some seasons, early November on shoots, spurs, around buds and, often, on trunks and main branches, sheltered positions being chosen, chiefly the lower sides of branches. Continued cold, wet weather may shorten the oviposition period to a month. In neglected plantations many eggs are deposited on dead wood, in moss and even on the eggs of other insects. The hatching period, which is unaffected by the weather, begins in April and lasts until the end of the month, or even mid-May, most of the mites appearing in the second week of April. They can exist without food for about a week, but attack the succulent leaves as soon as the buds begin to open. After a few days they are invariably found on the lower surface of the leaf, usually near the mid-rib. They become mature after the third moult and oviposit on the foliage and shoots. The summer eggs hatch in 3 or 4 days, and in warm weather the whole life-cycle is completed within a fortnight. Several generations overlap during the summer, but in August the mites become much less numerous and only eggs may be found in abundance. It is considered that these eggs give rise to the generation that lays the winter-eggs.

P. pilosus has a very wide range of food-plants, which include most kinds of fruit trees. Apples, plums, damsons and pears are frequently severely attacked, but certain varieties are more susceptible than others. Pears are usually more resistant than apples or plums. Infested trees may be readily detected by the silvery foliage ; sometimes new growth is dwarfed and stunted. Very little damage is caused through mild attacks, especially when they occur late in the season, but the mites often breed so quickly during May and June that the trees are badly injured.

Tar distillates, lime washes and other dormant sprays do not destroy the eggs, and in only one of the tests with oil sprays have as many as 50 per cent. been killed. Sulphur sprays may be used with considerable success, especially on apple, if correctly applied when the mites have hatched. A pre-blossom lime-sulphur spray (1:30) has proved the best. Apples should be sprayed about a week before the flower buds open, a sunny day being chosen for this, since lime-sulphur is more toxic to the mites on fine days. One application, if thoroughly carried out with a coarse nozzle, is usually sufficient; in very badly infested orchards, however, a post-blossom spray may also be applied, but at a reduced strength (1 : 80 or 1 : 100). The results on plums are not so good as on apples, because it is necessary to spray much earlier. As plums are very susceptible to spray injury, treatment should be completed before the flowers open. Potassium sulphide (liver of sulphur), prepared by dissolving 50 oz. fresh lump material in hot water and adding this to 5 lb. soft soap dissolved in 100 gals. water, is another excellent spray. It is applied at the same time as lime-sulphur (1 : 30) and is effective even in rainy or unsettled weather. It is thought that potassium sulphide destroys mites that hatch several days after it has been applied.

Massee (A. M.) & Steer (W.). **Tar-distillate Washes and Red Spider.**— *J. Minist. Agric.*, xxxvi, no. 3, pp. 253–257, 1 pl. London, June 1929.

Tar-distillate washes are wholly ineffective against the eggs of *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.), and it has recently been observed that where the washes are used on fruit trees for several years the mite becomes more abundant and is frequently an important pest. Observations during recent years support the theory that tar distillates destroy or discourage some parasitic or predacious insect that normally reduces the numbers of mites.

Anthocoris nemorum, L., a brief description of which is given, was frequently observed to feed on the mites and their eggs, particularly in the immature stages, as the adults are able to attack larger prey. The adult bugs often oviposit on leaves bearing an abundance of mites. The eggs are laid singly and partly embedded in the lower surface of the leaf. *A. nemorum* is common on all kinds of fruit trees and bushes as well as on hops. As all stages are to be found simultaneously throughout the summer, it is concluded that there are several generations during the year. The winter appears to be spent in the adult stage in any available shelter on the bark of the trees or on the ground. It is well known that *P. pilosus* is less prevalent in neglected orchards, where Anthocorids and other predacious bugs usually occur in far greater numbers than in regularly sprayed plantations. It is therefore reasonable to suppose that, since *A. nemorum* hibernates in the adult stage, winter washing has a deleterious effect on it by either depriving the adults of winter shelter by removing pieces of bark or actually killing them. This theory is equally applicable to other predacious bugs of similar habits. Although the Capsid, *Malacocoris chlorizans*, Fall., often feeds on the mites and their eggs, *A. nemorum* is the only species found by the authors to do so habitually. The two-spot ladybird beetle [*Adalia bipunctata*, L.], which also passes the winter in the adult stage, has occasionally been observed to feed on *P. pilosus*.

In spite of the increase of the mite involved, the authors advise the continued use of tar-distillate washes in view of their efficacy against Aphids and other insects, and advocate the use of sulphur preparations in the case of serious infestations of *P. pilosus* [see preceding paper].

HODSON (W. E. H.). **The Bionomics of** *Lema melanopa*, **L. (Criocerinae) in Great Britain.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 5–14, 2 pls., 15 refs. London, May 1929.

Lema melanopa, L., which is a serious pest of cereals in some parts of Europe, has become increasingly prevalent in Britain in recent years, particularly in the south-west of England. All stages of the insect are very briefly described, and its economic history in various countries is discussed. Since its life-history was found to vary in different localities, observations were made in Britain from 1924 to 1928. The adult beetles emerge from hibernation in April, and pair and begin to oviposit towards the end of May. Egg-laying continues for nearly two months, and the resulting adults emerge from early July until September. They feed chiefly on grasses before hibernating in November. In spring both adults and larvae feed almost exclusively on the leaves of cereals. Pupation occurs in the soil. The adults tend to be gregarious and are very long-lived, numbers surviving through a second winter. There is no indication of the occurrence of a second generation, although the climate would permit of one. Of the larvae collected in the field, 25 per cent. were found to be parasitised.

The control measures practised in other countries, which consist of cultural methods, spraying and dusting, are reviewed and their applicability to conditions in Britain is discussed. As severe infestations are usually at first restricted to strips along the sides of the field or other small areas, the larvae could be destroyed by early cutting. The cut plants should be dried rapidly, or removed and used as food for stock.

CHINA (W. E.). **An Addendum to Mr. F. D. Golding's "Notes on the Bionomics of Cotton Stainers** (*Dysdercus*) **in Nigeria."**—*Bull. Ent. Res.*, xx, pt. 1, p. 38. London, May 1929.

In Golding's paper on *Dysdercus* spp. occurring in Nigeria [*R.A.E.*, A, xvi, 233], it was suggested on the author's authority that the identity of three species was doubtful. Since that time he has examined Golding's material and now states definitely that the specimens of *D. nigrofasciatus*, Stål, and *D. migratorius*, Dist., taken in Nigeria were correctly identified, but that *D. intermedius*, Dist., does not, so far as is known, occur there. To the species recorded by Golding from that country, *D. antennatus*, Dist., must be added, although it is probably generically distinct from typical species of *Dysdercus*.

SCOTT (H.). **Note on the Life-history of the Fig-tree Moth,** *Ocnerogyia amanda*, **Staud. (Lymantriidae).**—*Bull. Ent. Res.*, xx, pt. 1, pp. 39–40, 2 refs. London, May 1929.

Further observations on the life-history of *Ocnerogyia amanda*, Staud., in Mesopotamia [*R.A.E.*, A, viii, 500] were made during 1928. On 27th May eggs were found in patches on the trunks and on the lower

surfaces of the leaves of fig trees, from a few inches above the soil to a height of about 10 ft., and although the time was 10–11 a.m., caterpillars in all stages of growth were found on the lower surface of the leaves high up in the trees [*cf. loc. cit.*]. On 9th June pupae were found at the bases of the trees on the trunks [*cf. loc. cit.*]. Trees close to mud walls surrounding the enclosures were most severely attacked, and it is suggested that the larvae may thrive better where there is shade at certain times of the day. Leaves at the tops of the trees were as badly injured as the lower ones, but this very exposed foliage was doubtless devoured at night.

Laboratory studies indicate that at this season the egg stage lasts 5–6 days and the larval stage about 21 days. In one case the pupal stage occupied only 4 days, but in most cases took several days longer. One female laid 120 eggs. At least one generation from egg to adult had been passed through, and the eggs of another generation laid before the end of May, a fact that confirms the view that the broods are continuous throughout the summer. During these observations the dry summer weather was at its height and the temperature rose daily to well over 100° F., but not usually to the high figures, above 110° F., experienced later in the summer. In the laboratory it was considerably lower.

BARRITT (N. W.). **Experiments on the Control of the Pink Boll-worm in Egypt.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 41–43, 3 refs. London, May 1929.

The author points out that although the Government has enforced vigorous measures for the control of *Platyedra gossypiella*, Saund. (including the compulsory ginning of all seed cotton before May and heat treatment of all seed cotton) throughout Egypt since 1919, no significant change in the extent of attack is shown in the figures given by Williams on the seasonal variation of this pest from 1916 to 1924 [*R.A.E.*, A, xiv, 199]. These figures show that the attack begins with about 5 per cent. infestation at the beginning of July, increases to 15 per cent. in the first week of August and then rapidly rises to 60 or 70 per cent. in the first week of September, after which every boll is attacked. It seems probable that this is due to the natural rate of increase of the insect when an abundant supply of bolls is available, and that the occurrence of only a few moths in each locality in June is sufficient to produce 100 per cent. attack in September. Thus, although 98 per cent. of the hibernating larvae may be killed by the control measures, the existence of larvae or pupae in fallen bolls buried in the soil or in bolls on cotton sticks stored for fuel is quite sufficient to start the outbreak in July [*cf. R.A.E.*, A, iv, 277]. Unfortunately it has not been found practicable to destroy these bolls, and the adoption of some control measure during July and August therefore seemed desirable. Experiments were carried out with a castor oil-resin emulsion [*cf.* next paper and *R.A.E.*, A, xvii, 418] used as a deterrent to oviposition. The results were inconclusive, but suggest the feasibility of control along these lines and the possibility of employing a protective belt of sprayed plants in fields that have not recently carried a cotton crop and in which buried bolls are not a source of infestation.

Barritt (N. W.). **A new Spray for Scale-insects on Citrus in Egypt.** *Bull. Ent. Res.*, xx, pt. 1, p. 44. London, May 1929.

Citrus in Egypt is severely attacked by scale-insects, particularly *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), and although hydrocyanic acid gas has proved very effective against them, it is liable to scorch the foliage and cannot be applied by unskilled labour. Moreover, fumigation must be carried out at night and cannot be used on trees that have overlapping branches or are otherwise difficult of access. In temperate climates scale-insects are usually controlled by resin and paraffin washes, which, being injurious to foliage, can only be applied during the winter. These sprays cannot be used on *Citrus*, which is not deciduous and only matures its fruit during the winter months, and a modified wash was therefore made by dissolving 1 part of resin in 3 parts of castor oil by heating over a flame, and emulsifying this solution in 50 parts of water containing 1 part of strong ammonia (·880). This emulsion can be sprayed with any ordinary machine, and on exposure to the air the water and ammonia evaporate, leaving a thin film of varnish on the surface of the leaves, which remains sticky for three or four weeks even under tropical conditions and proves fatal to both scale-insects and mealybugs. The varnish seals up the female scales and prevents any possible migration of the young. No effect on the assimilatory functions of the leaf has been observed, and the spray was applied with complete success on very heavily infested trees of sweet orange ; ten days after spraying not a single living scale could be found, and there was no sign of damage to the foliage. Spraying may be done at any time between March and October, so as to leave sufficient time for the fruits to outgrow the adhesive varnish, which, if applied later, would cause inconvenience in handling. It may be applied by unskilled labour and may be used before an infestation has become severe enough to justify fumigation.

Bagnall (R. S.). **On some new and interesting Thysanoptera of Economic Importance.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 69–76, 4 figs. London, May 1929.

Among the species discussed are *Brachyurothrips hargreavesi*, sp. n., on *Acalypha*, *Zeugmatothripoides africanus*, gen. et sp. n., on *Kola* and *Hoplandothrips hystrix*, sp. n., on the bark of grapefruit, all from Sierra Leone, and *H. coffeae*, sp. n., curling leaves of coffee, from Tanganyika Territory.

Ramakrishna Ayyar (T. V.). **The Economic Status of Indian Thysanoptera.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 77–79. London, May 1929.

The following species of thrips occurring in India are regarded as important from an economic point of view : *Thrips oryzae*, Williams, on rice in South India and Assam ; *Selenothrips* (*Heliothrips*) *indicus*, Bagn., on a variety of crops, including potatoes, cabbage, ground-nuts, onions, indigo and egg-plant ; *Scirtothrips dorsalis*, Hood, on chillies [*Capsicum*], castor, egg-plant, etc., in South India ; *Taeniothrips distalis*, Ky., and *T. longistylus*, Ky., common in South India on a variety of food-plants, and occasionally causing serious damage to ground-nuts and lab-lab [*Dolichos lablab*] ; *T. lefroyi*, Bagn., and

T. setiventris, Bagn., on tea ; *Thrips tabaci*, Lind., observed on cotton and cabbage, but not as a pest ; *Rhipiphorothrips cruentatus*, Hood, found on various plants, but only causing noticeable injury to grape-vines ; *Heliothrips haemorrhoidalis*, Bouché, seriously damaging garden crotons ; *Selenothrips rubrocinctus*, Giard., a well-known pest of cacao in other countries, which was noted on cashew nut trees, but not as a pest ; *Haplothrips tenuipennis*, Bagn., recorded as injuring tea in Assam during the last few years ; and *Arrhenothrips ramakrishnae*, Hood, and *Rhynchothrips vichitravarna*, Ramakrishna, causing serious leaf-curling on the garden plant, *Mimusops elengi*. A list is also given of other thrips noted on economic crops in India that may become of economic importance should conditions prove favourable.

Maulik (S.). **New injurious Hispinae.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 81–94, 10 figs. London, May 1929.

The following new species are described : *Promecotheca nuciferae* mining in older leaves of coconut in Celebes ; *P. soror* on coconut in the Moluccas ; and *Octotoma tessellata* and *Anoplitis canavaliae* on the foliage of *Canavalia ensiformis*, *Anisostena fasciata* on grasses, *Cephalolia saccharina* on sugar-cane, and *Chalepus bondari*, all in Brazil. The larva and pupa of *P. nuciferae* and *A. canavaliae* are also described.

Dekhtiarev (N. S.). **Notes on the Scarabaeid Beetles attacking Vines in Ukraine.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 95–98, 2 pls., 2 figs. London, May 1929.

In the sandy areas of the Ukraine that are most favourable for the cultivation of grape-vines, the larvae of various Lamellicorn beetles, which occur at an average rate of 10–12 to 11 sq. ft., often completely destroy newly planted vines in one summer, and have thus greatly hindered the successful exploitation of these barren regions. The larvae of *Polyphylla fullo*, L., are much the most destructive, but those of *Anoxia villosa* F., *A. pilosa*, F., *A. orientalis*, Kryn., and *Anomala aenea*, DeG., also gnaw the underground parts of the vine plant, and those of *Pentodon idiota*, Hbst., *Melolontha hippocastani*, F., and *M. melolontha*, L., often injure the roots in hard, black and clayey soils. Experience has shown that the larvae are not harmful to well-established vines, and some growers planted young vines much more densely than was necessary and replaced the ones destroyed, the surviving plants forming the foundations of a vineyard, but this method was often found to be entirely ineffective.

The Asilid, *Satanas gigas*, Eversm., is a very active predator that is widespread over the eastern and south-eastern parts of the Ukraine, but is exclusively found on sandy soil. The flies appear in numbers in the hottest sunny weather at the end of June and in July, but unfortunately most often attack the males of *P. fullo* owing to the fact that the females are comparatively inactive. Under artificial conditions the flies began to oviposit 1–2 days after pairing, laying about 100 eggs in the sand, but rarely depositing more than 5 at a time. The larvae hatch in 6–8 days and immediately burrow deeper into a damp layer of sand, where they feed by sucking the larvae of *P. fullo* and other Lamellicorns. The pupae are exceedingly active and work their way

to the surface prior to emergence. The Tachinid, *Microphthalma disjuncta*, Wied., often destroys a considerable proportion of the larvae; other Tachinids and species of *Tiphia* and *Scolia* are parasitic on *P. fullo*, but are much rarer than *M. disjuncta*. Hedgehogs occur commonly and destroy many beetles in the evenings; they are particularly useful as impregnated females of *P. fullo* have been found to form a considerable part of their diet. Moles are entirely absent from the sands of the Kherson district on the left bank of the Dnieper, where *P. fullo* does the greatest damage, and since in other districts, especially on the right bank of the Dnieper, they are not rare in the sands and are the most active predators of *P. fullo*, working as they do throughout the winter, the possibility of their artificial colonisation in this locality has been suggested.

Various artificial measures of control are discussed [*R.A.E.*, A, xvi, 218]. Paradichlorobenzene has proved most successful in sandy areas (in heavy soils the vapour cannot penetrate sufficiently), the optimum dosage being about $\frac{1}{4}$ oz. placed at a depth of 2–3 in. at the corners of a two-foot square with the vine in the centre. Applied in this way, about 240–300 lb. are required for an acre.

Wilkinson (D. S.). **New Parasitic Hymenoptera and Notes on other Species.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 103–114, 2 figs. London, May 1929.

The following new species are described: the Ichneumonids, *Mesochorus expolitus*, bred from *Charops* sp. parasitising the Nymphalid, *Acraea acerata*, Hew., in Uganda; and *M. concinnatus*, from an unknown host, but recorded as bred from the larvae of *Danais chrysippus*, L., in the Transvaal; and the Braconids, *Hecabalodes* (gen. n.) *anthaxiae*, from the Buprestid, *Anthaxia congregata*, Klug, in the Anglo-Egyptian Sudan; *Apanteles belliger*, from the Noctuid, *Cirphis unipuncta*, Haw., in Mauritius; *A. malevolus*, from the Noctuid, *Hyblaea puera*, Cram., in the United Provinces, India; *A. radiantis*, from the Noctuid, *Euxoa radians*, Guen., in Queensland; *A. grandiculus*, from a Lepidopterous borer in *Rubus* in Assam; *A. sagax*, from the Pyralid, *Sylepta derogata*, F., in Tanganyika Territory and Uganda; *A. mendosae*, from the Lymantriid, *Dasychira mendosa*, Hb., in the Federated Malay States; and *Opius phorelliae*, from the full-grown larvae of the Trypetid, *Phorellia peringueyi*, Bez., in the Transvaal.

Eulimneria stellenboschensis, Cam., is re-described from the type from South Africa and from a series of males and females bred from *Phthorimaea* sp. (presumably *P. operculella*, Zell.) on tobacco in Mauritius.

The synonymy of the following species is discussed: *Apanteles papilionis*, Vier. (*agamemnonis*, Wlkn.); *A. flavipes*, Cam. (*nonagriae*, Olliff [*R.A.E.*, A, xvii, 154]); and *A. ruficrus*, Hal. (*antipoda*, Ashm. [*loc. cit.*]), which is recorded from the Noctuids, *Heliothis obsoleta*, F., in Queensland, *Cirphis loreyi*, Dup., in the Anglo-Egyptian Sudan, and *Phytometra* sp. in Madras.

It is stated that the only known host of *Fornicia ceylonica*, Wlkn., is *Natada nararia*, Moore, the previous record of *Spatulifimbria* (*Spatulicraspeda*) *castaneiceps*, Hmps. [xvii, 156] being due to a misidentification. *Apanteles paludicolae*, Cam., previously only known from Ceylon, is recorded from the Pterophorid, *Sphenarches caffer*, Zell., in the Sudan. The true host of *A. leptoura*, Cam., is stated to

be the Pyralid, *Terastia meticulosalis*, Guen. *A. taprobanae*, Cam., is recorded from *Stauropus*, *A. importunus*, Wlkn., from the Pyralid, *Nephopteryx rhodobasalis*, Hmps. [*cf.* xvii, 154], and *A. taragamae*, Vier., from the Tineid, *Nephantis serinopa*, Meyr., all in India.

KING (H. H.). **A Note on the Use of Dried Poison Bait against Locusts in the Sudan.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 99–101. London, May 1929.

In the Sudan there are three species of migratory locust, *Anacridium moestum melanorhodon*, Wlk. (tree locust), *Locusta migratoria*, L., and *Schistocerca gregaria*, Forsk., of which the first two are relatively unimportant. From 1899 to 1917 swarms of *Schistocerca* occurred annually; then for a period of 10 years no damage was observed. In 1927 and 1928 outbreaks again occurred, and there is little doubt that they are to be expected annually over an extended period until the cycle terminates naturally or is artificially brought to an end. The swarms of adults appear from May onwards and oviposit in July and August in the arid regions when and where sufficient rain has fallen, the resulting generation of adults migrating in October. A certain amount of breeding takes place during the winter on the Red Sea littoral, where winter rains occur, but this district is relatively small and easily dealt with, the main problem being to prevent breeding during the summer rainy season throughout the vast arid or semi-arid areas of central and northern Sudan, which are very sparsely inhabited by nomad Arabs.

The various mechanical means of destroying hoppers are unsuitable for effecting the control of locusts over some thousands of square miles, and since unskilled natives were found incapable of using a spraying machine effectively or of mixing poison bran bait properly, experiments were made to find a bait that could be issued ready for use. One that had been sun-dried and only required moistening with water was tested during the winter of 1927–28 and during the rainy season of 1928, and reports on the results obtained were universally favourable. The stock solution is prepared by dissolving 168 lb. commercial sodium arsenite (80 per cent. As_2O_3) in water and making the solution up to 22 gals.; to this is added 92 gals. molasses. This stock solution is diluted in the proportion of 1 part by volume to 17 parts water, so that 9 gals. dilute solution contain 1 lb. sodium arsenite. In preparing the bait, the bran is heaped on a cement floor and dilute poison added at the rate of 12 gals. to 100 lb. The bran is thoroughly stirred until it is uniformly moist; it is then spread out to dry in the sun and subsequently passed through a coarse sieve to remove any lumps. The dried bait is put up in bags each containing approximately $9\frac{1}{4}$ lb., and the bags packed eight in a sack. One gallon of water is required to moisten the contents of one bag. The bait should be stirred in until evenly moist, left for ten minutes to absorb the water and become soft, and then broadcast thinly in the path of the hoppers.

After ingesting the minimum lethal dose of arsenic a well-grown hopper may live for up to three days. Dead and dying hoppers are devoured by their companions and, if their bodies contain sufficient arsenic, these hoppers also perish. The proportion of poison to bran is high, but owing to the difficulty of transport, it is advisable to try and destroy the maximum number of hoppers with the minimum amount of bait. It is believed that the risk of accidental poisoning of

men and domestic animals is not materially greater than if the proportion were lower. The molasses makes the bait more attractive and delays its drying up. Though the locusts appeared to prefer freshly prepared bait to bait that had been stored for two months and then moistened, the hoppers fed greedily on the latter, and adults flying not more than six feet from the ground detected its presence and settled to feed on it. Bait that has been in store for 10 months is still in good condition.

This bait has also been used with success against the larvae of *Agrotis ipsilon*, Hufn.

MELLOR (J. E. M.). **On the Preparation and Application of Arsenite of Soda Bran Bait (Khartoum Formula) for use against Locusts and certain Grasshoppers.**—*Leafl. Plant Prot. Sect. Min. Agric. Egypt*, no. 4, 12 pp., 6 figs., 2 refs. Cairo, 1929.

In view of the success obtained against locusts in the Sudan with a bran bait poisoned with sodium arsenite prepared in a concentrated form [see preceding paper], full particulars for its preparation and application are published in this leaflet. Details are given as to the quantities and costs of the materials required, with notes on mixing and the precautions to be observed, including instructions for preparing and administrating an antidote for arsenical poisoning. As the hoppers feed most readily in the early morning, the application of the bait should be begun not later than sunrise and may be continued for 3 hours. Towards the middle of the day the locusts are generally less ready to feed and the bait dries and usually ceases to attract them. Little is eaten just before and after moulting, and a few individuals that happen to be in this stage may escape poisoning; if many are found alive, a second light distribution of the bait should be made on the third day after the first application.

There was no opportunity of testing the bait against *Schistocerca gregaria*, Forsk., in Egypt during 1928, but it was successfully used against *Thisoecetrus littoralis*, Ramb., *Catantops axillaris*, Thnb., *Euprepocnemis plorans*, Charp., and *Aiolopus* (*Epacromia*) *strepens*, Latr. *Anacridium aegyptium*, L., did not eat the bait so readily as the others, and the dose necessary to produce death was higher.

Mediterranean Fruit Fly Quarantine. Notice of Quarantine no. 68, with revised Rules and Regulations.—*U.S. Dept. Agric., P.Q.C.A.*, 8 pp.

Mediterranean Fruit Fly Quarantine. Notice of Quarantine no. 68 (revised), with Regulations.—*U.S. Dept. Agric., P.Q.C.A.* multigraph, 4 pp.

[Administrative Instructions concerning Mediterranean Fruit Fly Quarantine.]—*U.S. Dept. Agric., P.Q.C.A.*, [Circulars nos.] 229 & 234, multigraph, 2 pp. Washington, D.C., 1929.

Owing to the discovery of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in Florida [*R.A.E.*, A, xvii, 443], the United States Department of Agriculture issued a quarantine (No. 68), with effect from 1st May, 1929, followed by various amendments, etc., all of which had come into force by 7th June.

To prevent the spread of *C. capitata* within the United States, the movement of fruits, vegetables and garden and orchard products of all kinds, soil, etc., vehicles and containers and all other articles

including nursery stock that have been associated with the production of or commerce in fruit or vegetables or contaminated with soil, etc., from any infested State into or through any other State, except under prescribed conditions, is prohibited. The restrictions may be limited to areas in an infested State, designated as regulated areas, when the movement of the restricted articles intra-state from regulated areas is adequately safeguarded.

The regulations define Florida as the only infested State. The inter-state movement of restricted articles from Florida will be allowed subject to the State enforcing prescribed eradication and control methods: Within every infested zone, which comprises all properties of which any part is within one mile of an infested property, all host fruits, *viz.*, wild and cultivated fruits, except water-melons, pineapples, coconuts and other nuts, and all host vegetables, *viz.*, peppers [*Capsicum*], gourds, pumpkins, squashes, tomatos, beans and egg-plants, must be destroyed or satisfactorily treated; and vehicles, containers and the soil of infested premises must be treated. Within every protective zone, which comprises all properties of which any part is within nine miles of the edge of an infested zone, a host-free period must be maintained each year for six months from 1st May, during which time no host fruit or vegetable may exist, except in storage or on retail sale for immediate consumption under approved conditions, and except citrus fruit on the trees in such stages of immaturity as not to be susceptible to infestation. Inspection must be carried on throughout the year; intra-state movement of restricted articles must be under satisfactory control; all places where fruits or vegetables are produced or handled must be under the control of the State.

No host fruit or host vegetable from Florida may be moved or re-shipped to any of 18 southern and western States or to Porto Rico.

Citrus fruits, except treated in such a manner as to eliminate danger of carrying the fruit-fly, may only be moved inter-state from Florida under permit. The inter-State movement of citrus fruits from an infested zone is not permitted, nor from a protective zone, except to the District of Columbia, Maryland, Pennsylvania and States north and east thereof. In 1929 the movement of citrus fruits from Florida was not permitted after 15th June. Other fruits may be moved from Florida only under certain conditions, and under permit. Under certain conditions host vegetables may be moved from protective zones under permit and from outer zones without permit, but the movement of tomatos, except when green, is prohibited.

The above restrictions do not apply to export from Florida ports direct to foreign countries.

No restrictions are placed on the inter-state movement of soil, etc., except from infested and protective zones. Nursery stock may only be moved inter-State from Florida under permit and may not be sent out of the State by mail.

Rules and Regulations of the State Plant Board of Florida concerning Mediterranean Fruit Fly Quarantines, etc., as amended and adopted 13th May 1929.—*Mon. Bull. Pl. Bd. Florida*, xiii, no. 11 (extra no. 2), pp. 184–198. Gainesville, Fla., May 1929.

These regulations on account of *Ceratitis capitata*, Wied., in Florida follow the lines of the Federal Quarantine [see preceding paper], the

requirements of which they fulfil, but are even more stringent. The quarantined areas in addition to the infested and protected areas include those in which the fly is considered likely to occur.

War against the Mediterranean Fruit Fly. Refrigeration of infested Fruit not an adequate Safeguard against Spread of Fruit Flies.— *U.S. Dept. Agric., P.Q.C.A.*, [Circulars nos.] 230 & 231, multigraph, 6 pp., 2 pls., & 4 pp. Washington, D.C., 1929.

The first of these circulars surveys the problem presented by the finding of *Ceratitis capitata*, Wied., in Florida and the danger of its spread to other States. The Federal Government has made £850,000 immediately available for control and eradication work.

The fly attacks almost all fruits grown in the United States as well as various vegetables. In Florida its favourite food-plant is grapefruit, and even in places where 100 per cent. of the grapefruit were infested, infestation in oranges rarely exceeded 5 per cent. Small quantities of infested fruit should be sterilised by heat or burnt ; larger quantities should be buried [see next paper]. If immediate destruction is not practicable, the State quarantine officer should be notified. To facilitate the recognition of the various stages of the fly, descriptions and figures are appended to this article.

In view of results of experiments carried out in South Africa and of the arrival of a large shipment of grapes from South America, which had been kept at a temperature of approximately 34° F. during the 18 days transit and found generally infested on arrival with living larvae of the fruit-fly, refrigeration of possibly infested fruit cannot for the present be considered a reliable safeguard against this or other fruit-flies.

Woglum (R. S.). **Battling the Mediterranean Fruit Fly in Florida.**— *California Citrograph*, xiv, no. 8, pp. 306, 330 & 332–334, 10 figs. Los Angeles, Cal., June 1929.

The territory infested by *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in Florida, was found at the beginning of May to cover an area about 70 miles square. A study of the temperature range in countries where this fly is most destructive indicates that tremendous losses to the fruit industry might occur in the entire southern United States if its distribution were to become widespread. It attacks many varieties of fruit, nuts and vegetables, 72 kinds of fruit having been found infested in the Hawaiian Islands. The greatest obstacle to eradication of the fly in Florida appears to lie in wild fruits becoming infested before they can be destroyed ; some of these occur in heavily wooded areas that are almost impenetrable. Most of the infestations are not very severe as yet, there being 1–6 larvae in an occasional grapefruit. Over 1,000 pupae were collected from the soil under a badly infested tree, and in the same orchard about 700 adults were obtained from another tree that was twice dusted with calcium cyanide. According to available information, the flies live only 4 days without food, but when fed, have lived for 10 months in captivity. The average life in summer, however, is 1–2 months.

The conditions of the Federal Quarantine [*R.A.E.*, A, xvii, 508] are briefly reviewed. In an infested area [*loc. cit.*], all the fruit is destroyed by being dumped into deep pits and covered first with

quick-lime or oil and then with earth to a thickness of 3 feet. It is thought that this legislation, though stringent, is not an absolute protection, for owing to the rate at which infestations have been discovered, an orchard may be found to be infested after the fruit has been picked and is on its way to market; furthermore, quantities of fruit were moved from the infested area prior to the date at which these regulations came into force. In California there is already a quarantine against citrus fruits from Florida on account of certain diseases, though not against other fruits attacked by *C. capitata* [but *cf.* xvii, 521]. The States of Louisiana and Alabama have put an absolute embargo against the shipment of all fruits and vegetables from Florida, one of the reasons being that cotton bolls at certain stages of development would be susceptible to the fly. Similar embargoes have been enacted in Santo Domingo and Spain.

Every effort should be made to prevent the introduction of *C. capitata* into California, the climatic conditions of which are comparable to those of Mediterranean countries, there being a danger of the fly being brought by tourists in fruit from Hawaii or even Florida; it is suggested that a thorough survey of the citrus belt in southern California would serve as a protective measure. Part of a previous account of the life-history of the insect is reproduced [*R.A.E.*, A, i, 510]. Lemons do not seem to be attractive to it, although it will oviposit in decayed ones. It is believed that there is an acid in the rind of the lemon, or some constituent of the fruit, that is repellent to it or prevents the eggs from hatching. In Hawaii, however, lemons are considered to be attacked.

Smith (R. H.). **Experiments with toxic Substances in Spray Oils in controlling Red Scale.**—*California Citrograph*, xiv, no. 8, pp. 315 & 326. Los Angeles, Cal., June 1929.

It has been found that heavy oils (about 100 seconds viscosity), when used in proportions sufficient to control red scale [*Chrysomphalus aurantii*, Mask.], damaged citrus trees, especially orange, and the use of either light oils (viscosity about 50 seconds) or lighter doses of heavy ones is desirable to lessen this injury. Although a highly refined light oil (unsulphonated residue not less than 90 per cent.) of a viscosity of 50 seconds will give complete control of black scale [*Saissetia oleae*, Bern.] and citricola scale [*Coccus pseudomagnoliarum*, Kuw.], if used in a quick-breaking emulsion at a concentration of 1½ per cent., it is not very effective against red scale. Attempts were therefore made to increase the efficiency of light oils by the addition of various toxic substances comprising three general classes, namely, organic compounds of certain metallic poisons, extracts from plants known to have insecticidal properties and purely organic compounds prepared by chemical methods.

It seemed necessary that any proposed substance should be more soluble in the oil than in water, otherwise it would pass into the latter in the spray tank. The task of determining the relative solubilities of the substances in oil and in water and of "fixing" in the oil certain ones that were more soluble in water presented great difficulties. The purest form of nicotine available (95 per cent.) is very soluble in water, but only slightly so in spray oils. Of the many substances tried, a few, including butanol (normal butyl alcohol), isopropyl alcohol, oleic acid and pine oil, were found to act as intermediate

solvents between nicotine and oil. One part of nicotine dissolved in 5 parts of butanol is completely soluble in 50–70 parts of oil. When the oil thus impregnated is mixed with water, however, the nicotine gradually passes into the latter. A highly refined kerosene oil with a viscosity of 30 seconds was used in nearly all of the tests, because when used alone it had but slight effect on the red scale. The impregnated oil was added to the water, and the mixture was immediately applied to fruit in the laboratory while being vigorously shaken. In the case of nicotine, it was thought that by this method at least 25 per cent. of it remained in the oil. The results, some of which are tabulated and discussed, were decidedly disappointing, and no combination of poisons showed any practical value. The possible ways in which red scale is killed by oil sprays are discussed.

DE ONG (E. R.). **Petroleum Oil as a Carrier for Insecticides and as a Plant Stimulant.**—*Indust. & Engng. Chem.*, xx, no. 8, pp. 826–827, 2 refs. Easton, Pa., 1st August 1928.

A study of spraying problems has shown that water, when used alone, is not well adapted as a diluent for sprays owing to its high surface tension, lack of cohesion between the liquid and solid, and lack of power to dissolve waxes. The result is an imperfect distribution of the chemicals over the leaf surface (especially when this is very waxy), imperfect wetting of the insect's body and dissolving of its protective covering of wax, and retardation of penetration into its breathing tubes, thus causing a lowered toxicity. Spreaders such as soap or casein reduce the surface tension, but do not greatly increase penetration or power to dissolve. Petroleum oil has many of the physical attributes that water lacks, and the highly refined fractions are safe for use on foliage. The refining process, however, usually removes much of the original insecticide properties, and the incorporation of more active chemicals is necessary. Oil-water emulsions may be made that are more efficient as carriers of insecticides and fungicides than water alone or with the addition of colloidal spreaders, and show superior spreading value and greater power of dissolving wax and penetrating the tracheae of insects. A study of the actions of oils on leaf surfaces has shown a high degree of penetration, irrespective of viscosity, which affects the rate rather than the degree of penetration. The behaviour of dye solutions in oil suggested that nicotine and other insecticides added to the oil would be carried into the body of the insect and thus increase the toxicity of the oil. For such work, uncombined nicotine should be used rather than nicotine sulphate, though the latter may be readily converted into free or alkaloid nicotine by the addition of a small amount of alkali. Nicotine is miscible in certain kerosenes up to 12 per cent., and the rate of volatility from light oils is similar to that from water. Nicotine-oil combinations when emulsified yield a certain amount of nicotine to the water until equilibrium is attained, but the oil carries the remaining nicotine into the tracheae, and increased toxicity is thus obtained. Experiments with *Lecanium corni*, Bch. (brown apricot scale), using 2 per cent. emulsions of oils alone and with nicotine, showed an average mortality of 79·5 per cent. for kerosene alone and 92·4 per cent. for kerosene containing 0·01 per cent. free nicotine. Other experiments with more viscous oils gave similar toxicities until the viscosity reached 100–110 seconds Saybolt, when the toxicity began to drop. This shows that the

nicotine is a more important factor in toxicity than the oil and that the latter may be varied within wide limits ; the oil thus acted as a carrier for the nicotine. The establishment of this principle of the use of oil for its physical rather than its insecticidal properties, makes possible the use of the more volatile and cheaper oil fractions. Volatile oils are safer for use on foliage, other factors being uniform, than those that persist in the leaf for long periods of time.

With regard to the effect of oil on foliage, acute injury is seldom seen with the type of oil now commonly used, but interference with normal functions, including the inhibition of starch formation, from the presence of oil in the cell structure, and disturbances of the transpiration rate may prove serious. Dormant spraying of trees is now sufficiently understood to enable the time of flowering to be stimulated or retarded, as desired, with a fair degree of certainty. Prune trees in central California sprayed during the latter part of November nearly always show a retardation of 5–7 days. Oils applied in December, during the period of the nearest approach to dormancy, cause little change in blooming time, but spraying during January produces early blooming, whereas later applications retard the bloom. It may perhaps be possible to secure a continued uniform increase in the set of fruit year after year without too great a drain on the vitality of the trees. Another beneficial physiological reaction of oil sprays noted in southern California is the reduction of injury to oranges and lemons from desiccating winds.

Fleming (W. E.) & Wagner (R.). **Miscible Carbon Disulfide.**—*Ind. & Engng. Chem.*, xx, no. 8, pp. 849–851, 1 ref. Easton, Pa., 1st August 1928.

A miscible carbon bisulphide that has recently been perfected is as effective as emulsions of this compound for soil fumigation against *Popillia japonica*, Newm. (Japanese beetle) ; it is no more injurious to the plants and has certain physical and chemical advantages. It is a mobile, transparent liquid with a specific gravity of 1·1156 at 15° C. [59° F.]. It does not form a heavy foam when shaken and can therefore be poured easily and measured accurately in small quantities. It mixes readily with water in all proportions, forming a white emulsion. Unlike emulsions containing soap and water, it does not stratify. It does not disintegrate under normal conditions and can be kept at a temperature of 32° F. for a week without breaking down. It is a mixture of carbon bisulphide with castor oil, potassium hydroxide, denatured alcohol and water, and as it can only be made satisfactorily with high-grade materials, the quality of each ingredient is specified in detail.

Sufficient potassium hydroxide is dissolved in a solution composed of 7 parts by volume of alcohol and 3 parts of water to give a concentration of 24·5–25·0 per cent. potassium hydroxide. A mixture of 55 parts by volume of castor oil with each 10 parts of this solution is then placed in a closed kettle equipped with a heating device and a mechanical agitator ; the agitator is started and the temperature gradually raised to 200° F. This temperature is maintained and the mixture agitated until the alkali has reacted completely with the oil. With small quantities, 2 hours at 200° F. was sufficient. The saponification may be tested by withdrawing small samples at intervals, mixing them with half their volume of carbon bisulphide and observing

their action in water; if the drop breaks into its component parts so that the carbon bisulphide settles to the bottom in droplets, saponification is not complete. When the reaction is finished, the alcoholic castor-oil soap is cooled to room temperature, mixed with carbon bisulphide at the rate of 35 parts by volume of carbon bisulphide to 65 parts of soap, and stirred until the mixture is homogeneous. The miscible carbon bisulphide may be used at once or placed in storage in tight containers. In order to assist the manufacturer in the preparation of a standard product, a procedure is suggested for analysing the finished material.

Hoyt (L. F.). **Fumigation Tests with Ethylene Dichloride-Carbon Tetrachloride Mixture.**—*Indust. & Engng. Chem.*, xx, nos. 5 & 9, pp. 460–461 & 931–932, 1 ref., 2 figs. Easton, Pa., May & September 1928.

In all these tests, the fumigating mixture of ethylene bichloride and carbon tetrachloride in the proportions 3 parts to 1 by volume advocated by Cotton and Roark [*R.A.E.*, A, xvi, 86] was used at the rate of 14 lb. to 1,000 cu. ft. All examples of *Plodia interpunctella*, Hb., in shelled peanuts, *Tineola biselliella*, Humm., in upholstered furniture, and *Tribolium confusum*, F., in flour, were killed when the fumigant was used in a gas-tight vault for 24 hours at 82° F. The odour of the fumigant and its effect on the eyes were such that it was impossible to enter the vault until it had been properly ventilated. In tests made in an 8,000 cu. ft. room on wheat germ infested with *T. confusum* and *Ephestia kühniella*, Zell., owing to the diffusion of the fumigant and the difficulty of raising the temperature of the wheat germ, which did not exceed 70° F. in the centre of the bags during the 24 hour fumigation, some of the insects were not killed immediately, but all died within the following 3 days.

Further tests were carried out in which wheat, flour, various food products and seeds were fumigated in a 500 cu. ft. vault for 24 hours at 75° F., the insects being *T. confusum* in flour and *P. interpunctella* in cereals. The fumigant was introduced into a trough at the top of the vault. Germination tests on wheat, oats, beans, peanuts, and clover showed no marked difference in the germinating power between fumigated and unfumigated seeds. Food products rich in fat absorbed the fumigant appreciably, but on exposure to air gradually gave it off and became edible in 1–8 days. Dried fruits and cereals in tightly wrapped cartons did not absorb detectable amounts of the fumigant. When examined an hour after fumigation, 26 adults and 5 larvae of *T. confusum* infesting flour that had been confined in a small sack buried in a paper sack of flour were all dead and no reinfestation of the fumigated sample occurred during 2 months following fumigation. Similarly, 24 full-grown larvae of *P. interpunctella* confined in a small sealed and tightly wrapped carton of rolled oats were all killed. There was no detectable difference in the odour, texture or general appearance of loaves baked from fumigated flour or flour ground from fumigated wheat.

In an additional test, material consisting of miscellaneous household goods, including rugs heavily infested with *Tineola biselliella*, was fumigated in a 7,800 cu. ft. storage room. Part of the fumigant was used to soak burlap strips suspended in the room, and the remainder splashed on the rugs and floor. The room was left for 44 hours at

a temperature that did not exceed 65° F. It was found necessary to use a gas mask while distributing the fumigant. Live larvae were confined in pill boxes and buried in overstuffed furniture, etc., to test the penetrative power of the fumigant. All those insects not already dead when the room was opened up died shortly afterwards.

BUCHANAN (L. L.). **North American Species of the Weevils of the Otiorhynchid Genus** *Mesagroicus.*—*Proc. U.S. Nat. Mus.*, lxxvi, art. 4, no. 2801, 14 pp., 2 pls., 1 map. Washington, D.C., 1929.

Among the new species dealt with are *Mesagroicus minor* on potato in Kansas, and *M. hispidus* on sugar-beet in California.

HOOD (C. E.). **Fish Oil as an Adhesive in Lead-Arsenate Sprays.**—*Tech. Bull. U.S. Dept. Agric.*, no. 111, 28 pp., 14 figs., 13 refs. Washington, D. C., May 1929.

This is a revision of a previous paper, which, together with some of the additional information given, has been already noticed [*R.A.E.*, A, xv, 289, 447 ; xvi, 679 ; *cf.* also xvii, 374, etc.]. In further experiments with coated lead arsenate paste [*R.A.E.*, A, xiii, 631] conducted in 1927, only 18·4 per cent. of As_2O_5 remained on foliage treated with coated lead arsenate at the rate of 10 lb. to 100 U.S. gals. water as compared with 51·6 per cent. on that treated with 4 lb. lead arsenate powder and 1 U.S. pt. fish-oil to the same quantity of water. The sprays were applied on 3rd June, and collections of foliage were made on 10th August after a total rainfall of 10 inches.

As a consequence of experiments conducted over a period of years, including tests with different quantities carried out in 1926 and 1927, the results of which are discussed in detail, it has been decided that the quantity of lead arsenate powder used for the extermination of the gipsy moth [*Porthetria dispar*, L.] and general control work can safely be reduced from 6¼ lb. to 5 lb. to 100 U.S. gals water if fish-oil is added as an adhesive. The spraying season can also be somewhat lengthened, as spraying operations can be begun when the foliage is small with good results. A few experiments have indicated that fish-oil is also a good adhesive for use with Bordeaux mixture or a combined lead arsenate and Bordeaux. Fish-oil should be added to the spray mixtures at the rate of 4 oz. by weight to each pound of lead arsenate powder or insoluble matter used. One U.S. quart of fish-oil weighs approximately 31 oz. No danger of arsenical residues is incurred if spraying is done at the time of the calyx application or while the fruit is very small, but it has not been sufficiently demonstrated that it is safe to use fish-oil sprays after these periods.

EYER (J. R.) & CRAWFORD (R. F.). **The Preparation and Use of Oil Sprays.**—*Bull. New Mexico Agric. Expt. Sta.*, no. 172, 20 pp., 10 figs., 1 graph, 4 refs. State College, N.M., January 1929.

The difference between miscible oils and oil emulsions is explained, and formulae and directions are given for making 4 per cent. sprays, using casein-lime, Bordeaux mixture or fish-oil soap as the emulsifier. A proprietary casein-lime is recommended, but if this cannot be obtained, a suitable substitute may be made by mixing 3 U.S. pints skim milk and 1 teaspoon hydrated lime in 1 U.S. gal. water and then

emulsifying with 4 U.S. gals. oil. The difficulty of obtaining a stable emulsion when soft water cannot be procured may be entirely avoided by using Bordeaux-oil emulsion, but this seems a little less effective as an insecticide then the others. The best time to use oil sprays is when the buds begin to swell, to avoid the danger of the spray freezing on the trees and injuring them.

A brief account is given of successful experiments in controlling San José scale [*Aspidiotus perniciosus*, Comst.] with a 4 per cent. emulsion, with notes on other orchard pests against which oil sprays can be used.

GENTNER (L. G.). **The Mint Flea Beetle** (*Longitarsus waterhousei* **Kutsch**).—*Circ. Bull. Michigan Agric. Expt. Sta.*, no. 125, 4 pp., 2 refs. East Lansing, Mich., April 1929.

An account is given of further observations on *Longitarsus waterhousei*, Kutsch (*menthaphagus*, Gent.) in Michigan, made since the publication of a paper previously noticed [*R.A.E.*, A, xv, 94], together with a brief review of its bionomics and control [*loc. cit.*]. Although the males are incapable of flight, the females have been observed to fly under certain circumstances. Mint plants free from infestation, planted in the spring of 1926, were found to harbour numerous gravid females in August, but no males. Since there was no mint in the neighbourhood, the females must have flown from mint at a distance. After the first emergence from the ground, when they feed continuously, the beetles feed mostly at night and hide during the day. They prefer shade and are active at much lower temperatures than many other insects. They migrate rapidly from fields where mint has been cut to adjacent standing mint and under certain conditions migration occurs to and fro between fields where second growth mint occurs after cutting. New mint is usually free from infestation until beetles migrate to it, as the roots are generally planted on clean-cultivated soil. Eggs, however, may be carried to new plantings when the roots are dug from infested fields without the soil being thoroughly shaken from them. Female beetles may also fly from infested fields to distant mint, but it has not yet been determined whether this flight occurs normally each year in the case of some of the beetles, or whether it occurs only when infested fields are destroyed.

Among predacious insects present in the soil in which the mint is grown, certain of which may attack various stages of the beetle, the Carabid, *Poecilus lucublandus*, Say, was observed to feed on live adults. A Dipterous larva identified as *Psilocephala haemorrhoidalis*, Macq., was observed in the roots of infested mint plants, and fed on the pupae of *L. waterhousei* when placed with them in soil in a glass vial.

GRAHAM (S. A.). **Host Selection by the Spruce Budworm.**—*Pap. Mich. Acad. Sci.*, ix, pp. 517–523, 3 refs. Ann Arbor, Mich., 1929.

The results of field observations and experiments recently carried out in Minnesota indicate to what extent the Hopkins food-plant selection principle [*cf. R.A.E.*, A, x, 83] influences *Tortrix* (*Archips*) *fumiferana*, Clem. (spruce budworm). It is estimated that during the period 1913–25 a volume of balsam fir [*Abies balsamea*] equal to ten million cords was killed by the budworm in Minnesota, in addition to

a large volume of white spruce [*Picea canadensis*]. No defoliation occurred in adjacent jack pine [*Pinus banksiana*], which is also susceptible to attack by *T. fumiferana*, and the epidemic finally died out in balsam fir and white spruce when the destruction of these species brought about a shortage of food for the Tortricids. Another attack by *T. fumiferana* occurred simultaneously in forests of jack pine on sandy lands to the south, separated by many miles from the former infestation. In this region balsam fir and white spruce growing among infested jack pines were practically immune from attack. It is therefore concluded that two forms of the budworm are concerned, one of which exhibits a decided preference for *A. balsamea* and the other for *Pinus banksiana*. As there appear to be no taxonomic differences between the two forms, they are regarded as ecological varieties of the same species.

Experiments indicated that at least from the third instar onwards the larvae are able to change from one food-plant to another without much difficulty, so that concentration on either jack pine or balsam fir and spruce in the different localities is probably not due to specific food limitations, but must be the result of specific food-plant selection on the part of either the adults or the larvae of the second instar, which is the first feeding stage. The decline of the outbreak made it impossible to test the reactions to food of the second instar larvae, but preliminary tests of food-plant selection by the adults indicate that they have a decided preference for the food-plants on which they were reared. The apparatus giving the most satisfactory results consisted of a T-tube $\frac{1}{2}$ in. in diameter, the stem of which could be connected with a larger straight tube containing the moths. At each end of the cross arm of the T-tube was an enlarged chamber into which fresh tips from the trees to be tested were placed. The outer ends of these chambers were closed with cheese-cloth to prevent the escape of the moths, and air was drawn slowly through the apparatus over the tips contained in the opposite ends of the cross arm and thence down the stem and through the moth tube.

Wilson (R. N.). **The Chinch Bug in relation to St. Augustine Grass.** —*Circ. U.S. Dept. Agric.*, no. 51, 6 pp., 3 figs., 1 ref. Washington, D.C., April 1929.

An account is given of *Blissus leucopterus*, Say (chinch bug) as injuring St. Augustine grass (*Stenotaphrum secundatum*) in lawns, golf courses, etc., in the south-eastern United States [*R.A.E.*, A, xv, 147]. In addition to the use of calcium cyanide, the author recommends the application of 1 lb. common laundry soap to 5 U.S. gals. water, or 1 part 40 per cent. nicotine to 800 parts water, with 1 lb. soap to 25 U.S. gals. These insecticides, however, have no effect on the eggs. The grass should be thoroughly deluged, and another application given two weeks later if more eggs have hatched.

Campbell (R. E.) & Duran (V.). **Notes on the Sugar-beet Army Worm in California.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 4, pp. 267–275, 7 figs., 9 refs. Sacramento, Cal., April 1929.

Laphygma exigua, Hb. (sugar-beet army worm) is not only a pest of beets in California, but also damages other crops and has recently been

very injurious to peas, cotton and peppers [*Capsicum*]. Four and occasionally five generations occur in a year. The time required for development is summarised as follows: eggs, 5 to 13 days; larvae, 16 to 76; prepupa, 1 to 14; pupa, 9 to 90. The adults live for 8 to 24 days, and females deposited an average of 330 eggs on peas and 459 on sugar-beets. All stages are found throughout the year, development varying greatly with climatic conditions. In the case of peas young plants only are attacked, the terminal leaves and shoots being destroyed and the plants either retarded or killed. A list of the natural enemies of this moth recorded in the United States is given. Control measures on peas are difficult; the tender terminal clusters may be destroyed before injury is noticed, and the larvae in them cannot easily be reached by an insecticide. Prompt and thorough application of 3 lb. lead arsenate to 100 U.S. gals. water, however, gave good results. A dust of 60 per cent. lime or sulphur to 40 per cent. lead arsenate on young and newly infested plants caused 60 to 70 per cent. mortality, and a second application one week later raised the total to 85 or 90 per cent., using 10 to 20 lb. of dust to the acre, according to the size of the plants. On peppers infestation was effectively checked by 7 to 10 lb. of undiluted calcium arsenate dust to the acre. The use of poisoned bran mash on cotton and the rolling of young beets has also been found successful.

Busck (A.). **A new Avocado Moth, *Amorbia essigana*, new Species. (Lepidoptera, Fm. Tortricidae.)**—*Mon. Bull. Dept. Agric. California*, xviii, no. 4, pp. 276–277, 1 fig. Sacramento, Cal., April 1929.

The Tortricid, *Amorbia essigana*, sp. n., is described from avocado in California. It has been reported as doing considerable damage to the foliage and also making surface burrows in the maturing fruit. This moth is closely allied to *A. cuneana*, Wals., which feeds on *Arctostaphylos glauca* and *Umbellularia californica* in California, and may eventually prove to be identical with it.

Departmental Activities.—*Mon. Bull. Dept. Agric. California*, xviii, no. 4, pp. 283–288. Sacramento, Cal., April 1929.

Sannina uroceriformis, Wlk. (persimmon root borer), which is of general occurrence in the southern States, was intercepted in California on persimmon seedlings imported from Kansas, but originally coming from Alabama. Larvae were boring up the main stalk almost to the point of branching, as well as working in the roots.

Nuts in the husk are now being refused entry into California, owing to the danger of introduction of nut pests in this manner. Larvae of the so-called pecan shuck worm, *Enarmonia* (*Laspeyresia*) *caryana*, Fitch, which is a serious pest of both pecan and hickory, have been intercepted in such nuts, and it is thought that the black walnut fly [*Rhagoletis juglandis*, Cress.] was introduced in them.

Ryan (H. J.). [**Insect Notes from**] **Los Angeles County.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 4, pp. 292–294. Sacramento, Cal., April 1929.

Chrysomphalus aurantii, Mask. (red scale), which has recently been very troublesome on an area of about 300 acres of *Citrus*, part of which

is adjacent to willows, was found to be heavily infesting willows and nightshade [*Solanum*] in the vicinity. These willows are to be cut down to the ground and the root systems left ; the willows will be cut back every few years.

A mosaic disease caused by an unfilterable virus is causing considerable damage to bulbs ; it is readily spread through sap transfusion and causes leaf and flower colour variation as well as dwarfing and twisting of the leaves, and the production of small and inferior bulbs. In most varieties it is transmitted by insects, such as Aphids, but narcissus, which is frequently infected, is free from insect infestation. In this case the disease may be carried by the instruments used for flower cutting. The recommendations are to rogue out infested plants and select healthy bulbs for planting.

Coccophagus gurneyi, Compere, the parasite of the citrophilus mealybug [*Pseudococcus gahani*, Green] introduced from Australia [*R.A.E.*, A, xvii, 271], has proved able to withstand the winter in Los Angeles and has been found to be parasitising from 15 to 50 per cent. of the mealybugs in various localities ; it is considered premature, however, to draw any definite conclusions as to its effectiveness.

Wright (W. H.). **The Dollar Sign in Walnut Pest Control.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 4, pp. 278–282, 2 figs. Sacramento, Cal., April 1929.

Some statistics are given on the cost of treatments for the codling moth [*Cydia pomonella*, L.] and Aphids on walnuts in California, and of the increased profits resulting from their use [*cf.* next paper]. Experience has proved the failure of dusts to control *C. pomonella* in walnuts. Both pests may be controlled by a spray of 15 lb. basic lead arsenate, 1 U.S. pint 40 per cent. nicotine sulphate and 3 lb. spreader to 300 U.S. gals. water. The spraying apparatus should include a tower, and the whole tree must be thoroughly covered. If Aphids occur alone, nicotine dust may be used.

Brock (A. A.). **Spraying vs. Dusting for Codling Moth Control.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 5, pp. 331–332. Sacramento, Cal., May 1929.

In addition to the fact that spraying with lead arsenate causes a higher mortality of the larvae of codling moth [*Cydia pomonella*, L.] on walnuts than dusting and that more poison is deposited on the nut by a spray, other factors such as the amount of poison applied to each tree and the relative costs of treatment should also be considered.

An average tree requiring 25 gals. spray would receive 1·25 lb. basic lead arsenate. For it to receive the same amount from a dust, it would be necessary to apply $8\frac{1}{3}$ lb. In field practice 4–6 lb. is considered a heavy dosage, but even if the full dosage were applied it would only be half as effective as the spray against the larvae. It is estimated that at present prices, the cost of spraying such a tree with lead arsenate and nicotine sulphate against codling moth and Aphids [see preceding paper] would amount to about 2*s.* $3\frac{1}{2}$*d.*, whereas the cost of a combined dust thoroughly applied would amount to 3*s.* $1\frac{1}{2}$*d.* The price of walnuts from treated orchards in 1928 showed an increase of from $1\frac{1}{2}$*d.* to $3\frac{1}{2}$*d.* per pound. These orchards had been sprayed against codling moth and Aphids in May and a larger number dusted against Aphids in July.

Smith (R. H.). **The Codling Moth as a Pest of Stone Fruits.**—*Mon. Bull. Dept. Agric. California,* xviii, no. 5, pp. 304–309, 2 figs., 8 refs. Sacramento, Cal., May 1929.

Inspection of a well-cultivated plum orchard in California during the years 1926–28 revealed the fact that about 0·5 per cent. of the fruit was infested by the larvae of the codling moth [*Cydia pomonella,* L.], and since there were no apple or pear trees sufficiently close to serve as the immediate source of infestation, it was concluded that the moth was maintaining itself on the plums independently of other food-plants. Walnut trees on one side of the orchard were uninfested in 1926 and 1927, and only very few larvae were found on them n 1928.

A limited survey of plum and peach orchards made in August 1927 showed many of the trees to be infested, some of the peaches as heavily as 65 per cent., but it is believed that in nearly all cases the moths had come from infested apples and pears in the vicinity. In one orchard, however, consisting of apricots, peaches and walnuts, with no apple or pear in the immediate neighbourhood, 3 per cent. of the freestone and 0·5 per cent. of the clingstone peaches were attacked ; the apricots had been picked, and the walnuts were uninfested. In the same orchard in June 1928, 1·4 per cent. of the apricots contained larvae, whereas examinations in July and August revealed only an occasional larva in the peaches and no infested walnuts, but there was little doubt that the moth had been maintaining itself on the apricots and peaches, although there had been an old neglected apple and pear orchard adjoining in previous years. Another apparently permanent infestation in apricots was observed in 1928, 2·5 per cent. of the fruit being infested in July, although there were no apple or pear trees in the vicinity.

Observations were made in order to obtain information on the life-history and habits of *C. pomonella* in stone fruits. On 23rd May, when plums were still hard and green, 3 per cent. contained larvae, the entrance holes being marked by mounds of frass. In the laboratory the first pupa was observed on 2nd June, the moth emerging on 18th June. On 4th June it was observed that large amounts of gum had exuded from the entrance holes, and it was estimated that about 20 per cent. of the larvae were killed by the gum. Larvae three-quarters grown were found in apricots on 9th June, and some of these pupated between 10th and 16th June. It was estimated that over 50 per cent. of the larvae were immature when the fruit was picked in the latter part of June, though many of the larvae in fallen fruit continued their development and reached maturity. No larvae were found in hard, green peaches, though they were found in those that had begun to colour. The marked tendency of the peaches to exude gum at a wound was responsible for the death of a large percentage of the larvae attempting to enter. Apparently plums and apricots are much more suitable food-plants than peaches. Excepting in the cooler coastal districts of California, *C. pomonella* usually has two generations a year. Only one generation would be able to develop on one variety of plum, apricot or peach. In the case of an early variety, the larvae of the last part of a brood would not be able to complete their development before the fruit was picked. A partial second generation might possibly develop in late varieties, although it is believed that a large percentage of the first brood larvae would be killed by the exudation

of sap from their burrows. Parts of the broods of two generations would be able to develop in an orchard containing both early and late varieties. Apples, especially varieties harvested in the autumn, remain on the trees throughout the entire summer, so that the development of two generations is uninterrupted. It is probable that the occurrence of *C. pomonella* in stone fruits is more prevalent than is at present supposed, and as the injury closely resembles that caused by *Anarsia lineatella*, Zell. (peach twig borer), it is possible that infestations have been overlooked.

Departmental Activities. Mediterranean Fruit Fly.—*Mon. Bull. Dept. Agric. California*, xviii, no. 5, pp. 319–320. Sacramento, Cal., May 1929.

A brief account is given of the discovery of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida [*R.A.E.*, A, xvii, 443]. It is probable that California has been protected from infestation from the eastern states by quarantines against fruits most liable to harbour the pest. The citrus canker quarantine prohibits the importation of all citrus fruits, the quarantine against the Oriental fruit moth [*Cydia molesta*, Busck] prohibits the importation of practically all stone fruits and pomaceous fruits, and other possible carriers of the fly have been almost automatically excluded because the production of similar commodities in the State prevents commercial transport to California owing to the high freight rates. The greatest danger to California lies in the fact that some fruits have been transported to other parts of the United States that do not prohibit the introduction of fruit from Florida ; these are now possible centres of infestation, and while commercial importations may not be made into California, travellers may bring fruit over the border in their luggage. For this reason an additional sum has been appropriated by the legislature, the quarantine service at all points on the border has been doubled, and six new inspection stations have been opened.

Brock (A. A.). **Water Washing for the Control of Citrophilus Mealybug.**—*Mon. Bull. Dept. Agric. California*, xviii, no. 5, p. 330. Sacramento, Cal., May 1929.

There has been considerable doubt as to the practicability of controlling infestations of the citrophilus mealybug [*Pseudococcus gahani*, Green] on *Citrus* by washing the trees with a large volume of water under comparatively low pressure, and experiments were undertaken to obtain information on this subject. The following observations were made by A. M. Boyce in the course of a progress report : Low pressure with high volume is more efficient than high pressure spraying for the removal of mealybugs. The operation can be very inefficient or highly efficient, depending on the care of the workman and the length of time spent on the individual tree. High pressure at the nozzle tends to increase the number of fruits cut off and clusters split. The washing was very effective in removing both young and adult red spiders [*Paratetranychus citri*, McG.], but had practically no effect on the eggs. A large number of the larvae of *Tortrix citrana*, Fern., and *Holcocera iceryaeella*, Riley, were dislodged. The cost of the operation for a full-grown tree, using 1,000 U.S. gallons of water per tree, was about 2*s*. The advisibility of applying this quantity of water to certain soils during the spring season is questioned.

Thomas (F. L.), Owen, jr. (W. L.), Gaines, jr. (J. C.) & Sherman (F.). **Boll Weevil Control by Airplane Dusting.**—*Bull. Texas Agric. Expt. Sta.*, no. 394, 40 pp., 11 figs. College Station, Tex., April 1929.

The use of aeroplanes for the distribution of calcium arsenate on cotton is briefly reviewed. In Texas, the area so treated has increased from 3,000 acres in 1925 to approximately 50,000 acres in 1928. This bulletin describes in detail observations of this method against the boll weevil [*Anthonomus grandis*, Boh.] on three farms, containing 400, 1,200 and 2,700 acres of cotton respectively. Three to five applications were made, the amount used being always more than 5 and sometimes $8\frac{1}{2}$ lb. to the acre. Within 10 days, after two applications had been made, the number of squares punctured by the weevils was reduced by 50 per cent., and increased yields of seed cotton varying from 63 to 206 lb. to the acre were produced wherever conditions warranted the use of control measures. The cost of dusting by aeroplane, including the poison, ranges from 3 to 4 shillings an acre, and the method is considered justifiable when infestation averages 15 per cent. early in the season or 20 per cent. later on, with weather conditions favourable to the weevils. Aeroplane dusting is particularly suitable where wet ground prevents the usual dusting at 5-day intervals. The price of cotton must be high to justify the expense ; as a rule small detached areas cannot be dusted by aeroplane so profitably as large ones. Detailed information and recommendations with regard to aeroplane dusting are included.

Dean (G. A.). **The Organisation and some of the Aims of the Central and National Plant Boards.**—*11th Rep. Kansas Ent. Commiss. 1927–1928*, pp. 22–31. Topeka, 1929.

The attempts that have been made to render uniform inter-state regulations regarding the movement of nursery stock in the United States are briefly reviewed. They have eventually resulted in the division of the country into four regional groups, organised as the Eastern, Southern and Central Plant Boards and the Western Plant Quarantine Board. These all send representatives to the National Plant Board. The uniform regulations adopted by the Central Plant Board in 1928 are given, together with the adopted list of nursery pests and the precautionary measures to be taken in connection with each, and the report of a committee of the National Plant Board on the principles of a quarantine is included.

Cotton (R. T.) & St. George (R. A.). **The Meal Worms.**—*Tech. Bull. U.S. Dept. Agric.*, no. 95, 37 pp., 8 figs., 34 refs. Washington, D.C., February 1929.

This paper is a fuller account of a study of the meal worms, *Tenebrio molitor*, L., and *T. obscurus*, F., already noticed [*R.A.E.*, A, xv, 399]. The additional information given includes numerous tables of the life-history data obtained, such as the length of the various stages, and oviposition records. A detailed description is given by the junior author of the mature larva of each species. The complete life-cycle of *T. obscurus* ranged from 114 to 675 days, and that of *T. molitor* from

311 to 649 days. The larvae are very resistant to starvation, a maximum survival of 9 months without food or water being recorded in the case of *T. obscurus*. All stages of both species were killed by an exposure of 1 hour to a temperature of 125° F. Eggs of both species were killed by exposures for 24 hours to a temperature of 30° F., but the other stages can withstand freezing temperatures when not as low as 10° F. These beetles appear to be free from attack by insect parasites, though a mite, *Tyroglyphus mycophagus*, Megn., has been recorded as infesting them in Germany [*R.A.E.*, A, x, 567]. Artificial control is easily secured by periodic cleaning up of refuse in mills, warehouses or granaries, or by fumigation with carbon bisulphide.

Holloway (T. E.). **The Sugar Cane Moth Borer and its Control in Mississippi.**—*Quart. Bull. Mississippi Pl. Bd.*, viii, no. 4, pp. 7–11, 2 figs. A. & M. College, Miss., January 1929.

This is a popular account of the measures advocated for the control of the sugar-cane moth borer [*Diatraea saccharalis*, F.] in Mississippi, where plantings are comparatively small. The seed-cane can be freed from borers by soaking it in water for 72 hours before planting. Grasses, including *Sorghum*, growing near the field, and any pieces of old cane should be cut down or destroyed if they contain borers. Any plants showing dead hearts as the cane comes up in the spring should be cut and destroyed. Seed-cane may be more rapidly treated by soaking for 20 minutes in water heated to 122° F., but this requires special equipment and may kill the cane.

Harned (R. W.). **May Beetles and Pecans.**—*Quart. Bull. Mississippi Pl. Bd.*, viii, no. 4, pp. 14–16. A. & M. College, Miss., January 1929.

During the past 8 years, 32 species of *Lachnosterna* (*Phyllophaga*) have been found on pecan trees in Mississippi, some showing a particular preference for pecans. The effect of the work of these beetles, which cause injury by feeding on the foliage, is most serious when they appear in large numbers and feed for several nights in succession just as the pecan buds are opening and the leaves beginning to develop. Observations over a period of years have shown that weather conditions in early spring are largely responsible for the time of appearance of the beetles. A cool March followed by a warm April is likely to cause large numbers to emerge about the time the pecan buds open, but if the nights remain cool until about the middle of April, the trees usually escape serious injury. Several successive days on which the temperature is above 70° F. at 6 p.m. are likely to bring out large numbers of beetles, which will cause much damage to the foliage of pecan and other trees.

The beetles hide on the surface of the ground during the day and fly at dusk. The eggs are laid on the ground, and the larvae often attack strawberries and grasses. Two or three years are required for their development to the adult stage. They pupate in cells during the autumn and emerge as adults the following spring. The larvae may be effectively controlled by cultivation of the orchards and neighbouring areas. Measures against the adults include hand picking at night with a lantern, the use of trap lights over tubs of water, and spraying with lead arsenate.

Harned (R. W.). **The Gouty and Horned Oak Galls.**—*Quart. Bull. Mississippi Pl. Bd.*, viii, no. 4, pp. 17–19, 1 fig. A. & M. College, Miss., January 1929.

Considerable injury to certain species of oak in Mississippi is caused by the Cynipids, *Andricus punctatus*, Bassett, and *A. corniger*, O.S., the galls of which are briefly described. The only method of control is the removal of the galls ; the galled twigs and branches should be cut off and burnt during February or March.

Lyle (C.). **Paris Green for Cutworm Baits.**—*Quart. Bull. Mississippi Pl. Bd.*, viii, no. 4, pp. 23–24. A. & M. College, Miss., January 1929.

In tests carried out in Mississippi during 1928 on *Agrotis ipsilon*, Hufn., *Prodenia ornithogalli*, Guen., *Laphygma frugiperda*, S. & A., *Feltia annexa*, Treit, and *F. malefida*, Guen., with cutworm baits in which the insecticides were used at the rate of 1 lb. to 50 lb. bran, the average mortality secured was 95 per cent. with Paris green, 53·6 per cent. with sodium fluosilicate mixed dry and 44·8 per cent. with dissolved sodium fluosilicate. A bait containing 1 lb. Paris green to 50 lb. wheat bran moistened with water is therefore recommended, to be applied broadcast at the rate of 10 lb. dry weight to the acre. This bait should be distributed in the late afternoon a day or two before plants are set in fields where cutworm injury is expected.

Ant Campaigns break all Records.—*Quart. Bull. Mississippi Pl. Bd.*, viii, no. 4, pp. 25–29. A. & M. College, Miss., January 1929.

An account is given of the campaigns carried out in 1928 in Mississippi against the Argentine ant [*Iridomyrmex humilis*, Mayr]. Although 50 per cent. more campaigns were conducted than in any previous year and a great reduction in the numbers of ants has been effected in many towns, the rapidity with which they are spreading in others where no measures are taken to check them indicates the necessity of extending the scheme of eradication to the entire State. If this step is not taken immediately, the ants will spread to the open country, where the cost of control would be too great for the scattered population. It is believed that if this ant should spread over the entire State it might, by destroying nestling birds, upset the natural control of insects, but even if it should cause only the damage of which it is known to be capable, the relief secured would justify the cost of eradicating it.

Tanner (V. M.). **The Mexican Bean Beetle in Utah.**—*Pan-Pacific Ent.*, v, no. 4, pp. 183–186, 7 refs. San Francisco, Cal., April 1929.

The history and distribution of *Epilachna corrupta*, Muls., in Utah, where it was first reported in 1921, are described. At present the beetle occurs only in three districts in two counties, but is slowly spreading. The adults hibernate under leaves or dead bark and emerge late in the following spring. Very few eggs have been found before mid-June. Early in July the larvae are half-grown ; eggs of a second generation, which is generally small, have been observed about 10th August. All varieties of beans are attacked, but no other plant has been found infested.

GARMAN (P.) & ZAPPE (M. P.). **Control Studies on the Plum Curculio in Connecticut Apple Orchards.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 301, pp. 371–437, 8 pls., 3 figs., 9 charts, 54 refs. New Haven, Conn., February 1929.

An account is given of studies, begun in 1923 and covering a period of six seasons, on *Conotrachelus nenuphar*, Hbst. (plum curculio) as a pest of apples in Connecticut. In infested orchards where no spraying is done, 50–60 per cent. of the fruit is ordinarily damaged and as much as 90 per cent. of the entire crop may be rendered unsaleable. The percentage of damaged apples in orchards subjected to various kinds of treatment in 1928 varied from 3·3 to 22·2. Life-history observations indicate that there is only one brood a year, all attempts to produce eggs from adults that had not hibernated having failed. The average length of the life-cycle in 1924 and 1925 was 55·3 days; eggs in fruit 7 days, larvae in fruit 15·9 days, larvae in soil 11·6 days, pupae in soil 11 days, and adults in soil 9·8 days. The length of the various periods varies from year to year, the average life-cycle in 1928 being only 47·9 days. Larvae placed in the soil at the same date sometimes vary as much as 3 weeks in their time of emergence as adults.

The adults emerge from hibernation early in May, but do not appear in large numbers until after the blossoms fall. The peak of abundance and egg-laying is reached about the middle of June, though the beetles remain in small numbers till the end of July. The larvae begin to leave the fallen fruit at the end of June and continue until August, most of the adults usually emerging in the latter month. Hibernation occurs in the adult stage, probably in woods or hedges adjacent to orchards and in contact with the soil. The adults will feed upon the foliage of peach and apple and even upon the petals of the flowers, as well as attacking the fruit. They need considerable moisture, and their distribution in the United States is much influenced by humidity. Trees with thick foliage providing abundant moisture in the interior are often heavily infested, and the beetles are more active on warm, damp, cloudy days than on dry, clear ones. They are much less abundant on trees after or during a high wind. The number of egg punctures made in fruit by one individual varies from 35 to 105. The greatest damage to the fruit is caused by feeding punctures made by the adults in autumn, when no eggs are laid in Connecticut. In the orchards where the experiments were conducted, however, autumn feeding punctures were not abundant on sprayed fruit. Beetles developing from dropped fruit left in the orchard offer a considerable menace to the crop of the succeeding year.

Parasites of *C. nenuphar* are not abundant in Connecticut, the most numerous being *Triaspis curculionis*, Fitch, which, however, did not kill more than 33 per cent. of the larvae obtained at any one time. The egg parasite, *Anaphoidea conotracheli*, Gir., was the only other species observed. A list is given of other natural enemies recorded in the literature.

All attractive and repellent substances hitherto tried have failed to exert any influence on *C. nenuphar* in the field, though capryl alcohol and benzaldehyde proved powerful repellents in cages. Laboratory tests have indicated that the beetles are partial to sweet substances and may be poisoned in captivity by mixtures containing

molasses. Of poisons used in cage experiments acid lead arsenate was the most effective.

Spray tests carried out in three different orchards from 1924 to 1928 indicate that in Connecticut three sprays will secure fair control, though better results are obtained with four (pink, calyx, 7-day and 2 weeks), which resulted in 94·2 per cent. unmarked fruit for all tests. The spray used contained 3 lb. lead arsenate, 6 lb. dry lime-sulphur, 1 lb. casein-lime and 100 U.S. gals. water. Occasionally good control may be secured by the omission of the 7-day and the addition of a 4 weeks application. The omission of the 7-day spray coupled with the use of fish-oil (1 pint to 100 gals.) and lead arsenate at the calyx period without lime-sulphur gives similar results to those secured with the 4 spray schedule, but the effect is on the whole less uniform. This schedule would be valuable on trees that scorch easily and are not subject to scab. There has been a gradual reduction of injured fruit in an orchard where dropped fruits were collected and wild apples in the vicinity sprayed. Basic lead arsenate gave less control of *C. nenuphar* than the acid form at the same rate per gallon and allowed too much damage by cankerworms to be practical at the rate used. Sprays gave slightly better results than dusts in a field test in 1928 [*R.A.E.*, A, xvi, 554]. Arsenical residues remaining on the fruit at harvest have been small enough in all cases to conform to the export tolerance.

Frequent disturbance of the soil destroys the mature larvae, 90–100 per cent. of which are found in the upper two inches after leaving the fallen apples.

HORSFALL (W. R.). **The Grapevine Sawfly (Hym.: Tenthredinidae).**—*Ent. News*, xl, no. 6, pp. 174–177, 1 pl., 2 figs., 4 refs. Philadelphia, Pa., June 1929.

An account is given of a study of *Erythraspides pygmaeus*, Say, which has been recorded as a vine pest in the United States, carried out in 1928 in Arkansas. It is there only known to occur on *Vitis cinerea*, which is used as an ornamental plant. The adult sawflies occur about mid-summer and are most active between 10 a.m. and 2 p.m. The eggs are inserted in the veins on the lower surface of the leaf. The male has a total of 5 larval instars and the female 6, and feeding occurs in all but the last. Larvae of the first two instars feed individually towards the edge of the lower surface of the leaf, causing the margin to curl downwards. In the later instars the larvae tend to be gregarious and leave little but the petiole and midrib of the leaf, migrating to another leaf as soon as one has been devoured. After the last moult, the larva drops to the ground and constructs an elliptical cell for pupation about one inch below the surface. Records of the duration of the stages taken from 10th July to 9th August with a daily mean temperature of 73–82½° F. in the insectary showed that the incubation period lasted 3–5 days; the larval feeding period 8–16 days for the male and 9–20 days for the female; and the total period spent under ground (last larval and pupal stage) 11–14 days, of which 4–5 days were spent as pupae. The pre-oviposition period lasted 2–3 days, and none of the females lived more than 6 days after emerging. All stages of the sawfly are described, the original description of the adult being quoted.

WINTER (J. D.). **The Identity of** *Aphis rubicola* **Oestlund and** *Aphis rubiphila* **Patch (Homop. : Aphididae).**—*Ent. News*, xl, no. 6, pp. 193–194, 4 refs. Philadelphia, Pa., June 1929.

From a comparison of alate viviparous females of *Aphis rubiphila*, Patch, taken on black raspberry in Ohio, the identification of which was confirmed by Dr. E. Patch, with the type slide of *A. rubicola*, Oestl., it is concluded that the former is identical with the latter.

Although comparisons of *Cerosipha rubifolii*, Thomas, and *A. rubicola* showed no significant differences except that the former has only 5 antennal segments instead of 6, the two species are distinct. Dr. C. W. Bennett found that *A. rubicola* would not satisfactorily live and reproduce on blackberry, whereas *C. rubifolii* breeds freely on this plant.

KISLIUK, jr. (M.). **Air Routes, German Dirigible "Graf Zeppelin" and Plant Quarantines.**—*Ent. News*, xl, no. 6, pp. 196–197. Philadelphia, Pa., June 1929.

The danger of the introduction of insect pests by aeroplanes or airships is briefly discussed, the problem being more difficult than that presented by ships coming to a definite port. Although all fresh food carried on the German airship that landed in New Jersey in October 1928 had been consumed during the journey, injurious insects were intercepted on flowers carried by the passengers, including *Myzus persicae*, Sulz., and other Aphids and Coccids, *Thrips tabaci*, L., *Typhlocyba rosae*, L., and Noctuid eggs and a Noctuid cocoon.

Record of current Work, July 1 to December 31, 1928.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A. no. 97, pp. 96–111. Washington, D.C., May 1929.

In connection with the date scale, *Parlatoria* [*blanchardi*, Targ.] reconnaissance surveys and intensive eradication operations have been carried on in the date-growing areas of the south-western United States [*cf. R.A.E.*, A, xvii, 222].

The rate of spread of the European corn borer [*Pyrausta nubilalis*, Hb.] to the south in Indiana and Ohio decreased, but eastward in New England and westward in Indiana it was more rapid. In the east, the one-generation strain was discovered for the first time in New Hampshire and Connecticut, and in the west, it reached the shores of Lake Michigan. The two-generation strain has spread westward into parts of Connecticut. The only commercial damage (400–500 borers to 100 maize stalks) occurred in Rhode Island. The intensity of infestation by the gipsy moth [*Porthetria dispar*, L.] in New England has increased since 1924, in which year it was less than it had been for 20 years. In New Jersey the moth appears to be approaching extinction. The Japanese beetle [*Popillia japonica*, Neum.] was recorded from a few localities more or less isolated from previous centres of infestation.

The pink bollworm [*Platyedra gossypiella*, Saund.] was not found on cotton in 1928 in the northern part of the regulated and previously infested area, but whether this was due to the severe winter or to the control methods practised was not determined [*cf. loc. cit.*]. The Mexican fruit-fly [*Anastrepha ludens*, Lw.] has not been found since

June 1927 in the lower Rio Grande Valley of Texas, owing primarily to the maintenance of the host-free period throughout the regulated area.

Polivka (J. B.) & Herr (E. A.). **The Behavior of the Corn Borer in Stored Corn.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, no. 138, pp. 103–105. Wooster, Ohio, May–June 1929.

In order to estimate the importance of stored maize as a hibernating place for larvae of the corn borer [*Pyrausta nubilalis*, Hb.] and as a possible source of re-infestation, the numbers occurring in 50 cribs distributed over a heavily infested area were determined in April and May 1927. An average of 800 bushels of maize was stored on each farm, and the number of borers was found to be about two to each bushel, but it was estimated that half the total amount of maize was sold before the flight period of the moths in late June and early July, and that half the remainder was used as food for animals, so that an average of about 400 borers was available in stored maize for re-infestation.

In order to ascertain the number of borers able to emerge from the stored maize and the period of emergence, 600 infested ears were placed in cages under conditions similar to those in a crib. The moths began to emerge on 8th July and continued to do so until 21st September, showing that emergence is retarded and prolonged by dry storage conditions, since in the field it was completed by 14th July. Dissection of the ears late in September showed that 54 per cent. of the borers had emerged as adults, 23 per cent. were living larvae, 18 per cent. had died in the larval stage and 5 per cent. in the pupal stage. The living larvae were placed in corrugated paper strips and kept under dry storage conditions to determine whether any of them would survive until the next season, but by 22nd November there were few living larvae and these soon died.

In order to obtain further data on the seasonal history and behaviour of the borers in the cribs, infested ears were placed in cages that were tightly covered with 18-mesh screen and buried in the maize in the crib. Ears from these cages were dissected at intervals. In the first dissection, on 15th July, only one dead larva was found, but the number of dead larvae increased with each succeeding dissection period until, at the final one, on 24th September, the larval mortality had reached 30 per cent. The emergence prior to 15th July was 12·3 per cent. as compared with 48 per cent. on 24th September. The combined results from the two series of cages showed that about 51 per cent. of the borers in crib storage emerge as moths, and as the progeny of moths that emerge late is of little importance in damaging the crop, it is concluded that stored maize when kept dry is not an important source of re-infestation in Ohio.

Chambers (E. L.). **Division of Insect and Plant Disease Control.**—*Bienn. Rep. Wisconsin Dept. Agric. 1927–28*, Bull. 98, pp. 81–126, 10 figs. Madison, Wis., March 1929.

The work of the Division of Insect and Plant Disease Control in 1927 and 1928 is reviewed. The outbreak of the hemlock spanworm [*Ellopia fiscellaria*, Gn.] [*R.A.E.*, A, xv, 294] appears to have been controlled, though it has been discovered defoliating trees to a limited

extent in other parts of the State. Large tracts of trees have also been defoliated by various pests, including the willow leaf beetle [*Plagiodera versicolor*, Laitch.] on oak, birch, beech, elm, maple, etc., the spruce budworm [*Tortrix fumiferana*, Clem.] and the white pine weevil [*Pissodes strobi*, Peck].

As a result of recent State and Federal legislation all the State plant quarantines were revised or re-enacted, and reprints of the new orders are given in this report.

Although control measures for most of the more serious pests of cranberry are known, no satisfactory method has yet been devised against the cranberry fruit-worm [*Mineola vaccinii*, Riley], which in recent years has probably caused more damage than all the other pests combined.

Isely (D.). **The Southern Corn Rootworm.**—*Bull. Arkansas Agric. Expt. Sta.*, no. 232, 31 pp., 1 pl., 11 figs., 8 tables, 3 pp. refs. [Fayetteville, Ark.] January 1929.

The larvae of the Galerucid, *Diabrotica duodecimpunctata*, F. (southern corn root-worm) are serious pests of maize in low damp localities in Arkansas, and they also attack a number of other plants, particularly grasses. They bore into the underground parts of the stems of maize seedlings and kill the central leaves ; in some fields as many as 75 per cent. of the plants may be destroyed. Larger plants, when infested by many larvae, grow slowly, sometimes become badly dwarfed and yellow, and may produce no grain, the attack being always on the roots. The adults feed on nearly all cultivated plants, preferring the flowers, and sometimes seriously injure cucurbits [*cf. R.A.E.*, A, xiv, 451] ; pollination may be prevented in maize, the foliage of which, as well as of other grasses, is rarely attacked. All stages of the beetle are described, and brief notes are given on insects that may be confused with it.

The immature stages are found from early spring to late autumn, and as the time required for each is more variable than if they occurred only at a particular part of the year, the relation of temperature to the rate of development was investigated. The methods employed are described, and the results tabulated and discussed. The time required for development from egg to adult at temperatures prevailing in April and May may exceed two months, whereas in mid-summer it may be less than a month.

The beetles are active in early spring, and the insect probably hibernates in the adult stage in the northern part of its range. Along the Gulf Coast, however, all stages possibly occur at all times of the year. In Arkansas, the earliest date on which the adult was collected was 7th March and the latest 12th November. The earliest record of oviposition in the outdoor insectary was 27th March. Overwintered adults continue to lay eggs until after 1st June. The pre-oviposition period of 7 females of the first and second generations ranged from 15 to 22 days. The egg-laying period of 8 females of the first generation averaged 42 days ; two of them continued to oviposit for over 60 days. Three generations were reared in the insectary, and on the approach of cold weather the breeding material was removed to a greenhouse, where a fourth was produced. Hibernation apparently does not occur in any definite generation. Larvae of the first generation probably

cause most of the serious damage to maize, although small maize may be badly injured as late as mid-July, adults of the overwintered generation and of the first being the most harmful to cucurbits. The conditions most conducive to serious injury are moist soil, the presence of wild infested grasses in the field before the latter is planted with maize, and a crop at the most susceptible age (within 2 weeks of coming up) when the larvae are half-grown and older. Maize that comes up before eggs are deposited in the field will be past the most susceptible stage by the time the larvae hatch. In rearing work, it was found that none of the immature stages would develop in dry soil and that the beetles would not oviposit in it.

The Tachinid parasite, *Celatoria diabroticae*, Shim., has been reared in small numbers, but is apparently not of much importance. When beetles are numerous enough to damage cucurbits, they may be controlled by sodium fluosilicate mixed with hydrated lime, 1 : 3, and arsenical dusts may be used as repellents to protect flowers. Against the larvae, however, no form of insecticidal control has been found effective, and it is recommended that low damp areas should be kept free of wild grasses for a month before being planted with maize. Planting should be postponed till 1st June in fields where injury is likely to occur. Where it is impossible to keep down wild grasses owing to the continuance of heavy rainfall until June, maize should not be grown. Other agricultural measures that have been suggested by various authors are briefly discussed.

SCHRADER (F.). **Experimental and Cytological Investigations of the Life-cycle of *Gossyparia spuria* (Coccidae) and their Bearing on the Problem of Haploidy in Males.**—*Z. wiss. Zool.*, cxxxiv, no. 2–3, pp. 149–179, 2 pls., 18 refs. Leipzig, June 1929.

In an introduction to this cytological study the author states that although *Gossyparia spuria*, Mod., is often harmful to elms, it does little damage in Pennsylvania, where there is only one generation a year. The young insects hatch in the summer, grow very slowly and hibernate in the second larval instar. In the following spring the males undergo two further moults before emerging as adults. The females have only one more moult before being ready to pair. The eggs are produced from May to August.

In field collections, males and females are found in approximately equal numbers, if the total counts of several seasons are considered. Controlled breeding experiments showed that any single female produces both males and females. Fertilisation is necessary for development, and parthenogenesis does not normally occur.

Canada: Destructive Insect and Pest Act. Regulation no. 4 (Foreign) 2nd Revision.—1 p. Ottawa, 1929.

The importation into Canada from Hawaii and Florida of all plants, non-canned fruits or other plant products is prohibited, as from 2nd July 1929, unless they are certified to have originated in a district free from infestation by the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.]. Pineapples, bananas and coconuts may, however, be imported from Hawaii if certified free from infestation.

Macleod (D. J.). **The Black Leg Disease of Potatoes** (*Bacillus phytophthorus* (**Frank**) **Appel**).—*Pamph. Canada Dept. Agric.*, N.S., no. 105, 10 pp., 3 pls., 25 refs. Ottawa, 1929.

The relation of *Phorbia cilicrura*, Rond. (*fusciceps*, Zett.) (seed corn maggot) to black leg disease of potatoes, which is widely distributed in Canada, is discussed, and the method of dissemination of the disease described in detail [*R.A.E.*, A, xiii, 176; xiv, 269]. The measures suggested for its control include selection of healthy seed potatoes, which should be disinfected in a solution of formalin or mercury bichloride, and should not be planted in wet soil, which favours the disease. They should be planted immediately in order to minimise opportunities for *P. cilicrura* to oviposit on the seed pieces. Pieces that have been exposed for some time in the field frequently show a high percentage of infection. All infected plants should be removed from the field. The disease may be transmitted by the knife when seed potatoes are being cut; it should be sterilised if a tuber that shows traces of rot has been cut.

Smith (F. E. V.). **Entomogenous Fungi. Insect Pests in Jamaica 1928.**—*Ann. Rep. Dept. Agric. Jamaica 1928*, pp. 19 & 20–21. Kingston, 1929.

The results of further experiments with paradichlorobenzene against *Cosmopolites sordidus*, Germ. (banana borer), which continued to cause trouble particularly in old ratoon fields, were not so satisfactory as had been expected [*R.A.E.*, A, xvi, 527]. A special investigation of scarring of bananas showed that the damage was principally due to slugs, though it is possible that some of it may have been caused by insects. Miscible oils, though effective in controlling Coccids and the black-fly [*Aleurocanthus woglumi*, Ashby] on *Citrus*, are still too expensive for general use. Experiments in infecting the pimento whitefly [*Aleurodicus pimentae*, Lg.] with the fungus, *Aschersonia aleurodis*, proved successful in two cases. *Laphygma frugiperda*, S. & A., attacked sugar-cane and other crops. It is claimed that termites, which caused damage to sugar-cane in association with root disease, were checked by ants attracted by the application of fresh pieces of coconut to the affected parts. Sweet potato was injured by *Corecoris fuscus*, Thunb.

Hardy (F.). **Froghopper Incidence in 1928.**—*Min. & Proc. Froghopper Invest. Comm. Trinidad & Tobago*, pt. xv, pp. 261–268. Trinidad, 1929.

In 1928, adults of the first generation of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] appeared in most districts in Trinidad during the first half of July; second-generation nymphs appeared during the last fortnight of August and were followed by second-generation adults in the first half of September. The third generation appeared in early October. Observations in September showed that in the districts where prompt and thorough dusting with calcium cyanide against the first-generation nymphs had been practised, the froghopper was under control, but in other districts it was spreading. Considerable numbers of first-brood adults were caught in light traps [*cf. R.A.E.*, A, xv, 49]; a more portable type of electric light trap is being tried. The green muscardine fungus [*Metarrhizium anisopliae*]

appeared late in the season and did not exert much influence until October; rains in December, however, encouraged its development and late adults were quickly destroyed by it. Syrphid flies were not numerous until the end of the year. Detailed records of the incidence of the froghopper on various estates are appended.

TURNER (P. E.). **The Lime Status of Soil in relation to an Insect Pest of Sugar-cane.**—*J. Agric. Sci.*, xix, pt. 1, pp. 26–35, 9 refs. Cambridge, January 1929. Reprinted in *Mm. & Proc. Froghopper Invest. Comm. Trinidad & Tobago*, pt. xv, pp. 269–281, 9 refs. Trinidad, 22nd May 1929.

The injury to sugar-cane by the froghopper, *Tomaspis saccharina*, Dist., in Trinidad appears to depend largely on the condition of the soil in which the cane is grown. Investigation has shown that the mechanical composition of the soil and its organic content bear little relation to the damage caused, but the soils of infested areas were found to be devoid of calcium carbonate and generally markedly acid, while those free from infestation almost invariably contained traces of it and were alkaline or only slightly acid. The lime status of the soil therefore seems to be a factor of primary importance. Determination of the contents of exchangeable calcium of the soil of typical infested and uninfested areas has confirmed this view. In areas of uniform soil texture in which the other factors associated with the susceptibility of sugar-cane to injury are approximately constant, a very close relationship exists between the soil content of exchangeable calcium and the damage sustained by the cane.

NEWMAN (L. J.). **The Subterranean Clover Weevil** (*Listroderes praemorsa*).—*J. Dept. Agric. W. Aust.*, vi, no. 1, pp. 29–36, 6 figs. Perth, March 1929.

During the winter and spring of 1928 subterranean clover (*Trifolium subterraneum*), which is one of the most important field fodder crops in Western Australia, was severely damaged by the attacks of *Listroderes praemorsa*, Lea, in several areas in the south-west of the State. This weevil has been known as a minor pest of garden crops, such as tomatos and potatoes, for many years, but this is the first record of its appearance as a serious pest of clover. Common cape weed (*Cryptostemma calendulaceum*) is a favoured food-plant, but subterranean clover seems to be preferred when available. Other clovers and grasses do not appear to be seriously attacked.

The larva, pupa and adult are briefly described. The larvae are gregarious and feed mainly at night and on dull days. The larval stage lasts from 12 to 14 weeks, and the mature larvae then burrow into the soil to a depth of 1½–2 ins. and pupate. Pupation takes place from the latter part of August to the end of September, and under laboratory conditions the pupal stage lasted 17–21 days. The adult remains in the earthen cell for two or three days before emerging. Although wings are present, flight has not been observed. The adult weevils, which live for several months, appear mainly in October and November, though some individuals emerge in September. At this time the clover and grasses are drying up and the weevils apparently hide during the summer in cracks and crevices in the soil, under logs, stones, loose bark, etc. Many of them die during this period, but on the advent of

the autumn rains the survivors probably reappear and oviposit amongst the young clover seedlings. There is only one generation a year, with considerable overlapping of the various stages. The young larvae attack the foliage, feeding on the lower surface of the leaves, but the older larvae attack both foliage and stems and leave the ground bare. As the young grubs grow they work outwards from the centre, forming characteristic circular patches, which eventually coalesce and may extend over an acre. The clover eaten to the ground never made a satisfactory recovery.

In the course of these investigations it was found that clover grown continuously tends to be overcome by an accumulation of insect pests, diseases and weeds, and this should be prevented by fallowing clover fields every third or fourth year. Ploughing should be carried out as early as possible in the spring (not later than mid-September) so that the young larvae are turned under and starved, for, if the weevils are allowed to reach the pupal stage, many of them will survive. The fallow land, which should be kept free from weeds, may be sown with oats and clover in the following autumn. All heaps of rubbish, long grasses or weeds, which might afford shelter to the aestivating weevils, should be burned. To prevent the spread of the weevil, only cleaned seed should be used, since eggs may be laid on the heads before harvest, and infested clover hay should not be carted about. Heaps of rubbish regularly examined may be used as traps for the adult weevils. A poison bait, composed of 30 lb. bran, 4 lb. molasses, 1 lb. sodium arsenate or Paris green, and enough water to form a crumbling mash, gave excellent results, the quantities given being enough for one acre. It should be distributed along the line of advance of the larvae, but not on the area already denuded by them, since they are only found on the edge of the growing clover. Lead arsenate as a spray ($\frac{1}{2}$ lb. powder to 16 gals. water), applied along the edge of the clover patch just in advance of the grubs, or as a dust on the moist foliage, was also effective. The ploughing or cutting of a steep trench in front of the larvae in conjunction with the use of poisons seems to check their advance, as they are not apparently able to cross the ditch, and poison bait placed in the furrow will destroy any that may fall into it. The isolation of each infested patch by encircling it with a trench and applying poisons is recommended.

HILL (G. F.). **The Tasmanian Grass Grub (*Oncopera intricata* Walker). A preliminary Report on its Life History and Methods of Control.** —*Pamph. Council Sci. Ind. Res. Australia,* no. 11, 43 pp., 6 pls., 6 refs. Melbourne, 1929.

Investigations on the Hepialid, *Oncopera intricata*, Wlk., were undertaken in Tasmania from 1926 to 1928. As this moth had previously been recorded as a serious pest of grasses in Victoria, investigations were also made in that State and it was found that a species of *Oncopera* is a minor pest of grass, but that no serious outbreaks had been reported for many years. Its numbers are reduced by insectivorous birds; a few of the larvae were found to be affected by a fungus and by a disease that may have been of a bacterial nature, but no insect parasites were observed. A species of *Oncopera* in the South Australian Museum was ascertained to have been taken in South Australia, but a survey of the district failed to reveal further examples of it.

In Tasmania attention was concentrated on the type of pasture comprising first class arable land sown with introduced grasses and clover in rotation with annual crops, since the possibility of controlling *O. intricata* in the larger and less cultivated types of pasture appeared to be remote.

All stages of the insect are described. The female lays an average of 500 eggs, which are all deposited at one time, though sometimes in two or three groups, in sheltered situations on the ground. The egg stage probably lasts 63–70 days. The habits of the larvae are discussed in detail. Observations on experimental plots showed that during the first two days the newly hatched larvae live gregariously under a light web. On the third day young grass in the vicinity is attacked either by larvae that emerge from the shelter of the web or by those that have migrated outwards and commenced an independent existence under their own covered ways, which may by this time encircle the stem of a young grass plant. The plant is cut through at ground level, the upper portion being partly devoured and partly used to extend the covered way, and the lower eaten away below the surface, leaving a small vertical hole, which forms the commencement of the characteristic larval burrow. Other larvae feed for some time before making their burrows. The burrow is deepened and widened throughout the winter and early spring, and the covered ways are extended to, and around, new plants. From the beginning of August the larvae become increasingly destructive until about the beginning of November, when the most advanced are full-grown. When occupied by full-grown larvae, the burrows vary from $5\frac{1}{2}$–12 ins. in depth. If the burrow is situated at some little distance from the nearest food-plant, a tube-like extension of the covered way is usually formed to connect the two, but the feeding ground may extend over an unprotected area of 6 or more inches. Ordinarily healthy larvae are only found on the surface of the ground at night. All varieties of grass and herbs ordinarily grown for pasture, including clovers, are attacked, but thistles are apparently never eaten. Grain crops generally escape injury because routine farm practice effectively controls this moth, but under certain conditions extensive damage may occur. There is strong evidence that a partial migration involving the construction of new tunnels may take place when the food-plants on a particularly heavily infested area are devoured.

The first pupae were found in the burrows at the beginning of January. Under natural conditions most of the moths emerge between 6 and 7 p.m.; they are on the wing towards the end of January and early in February. The mating flight lasts from 40 to 55 minutes. On windy nights the moths have been seen to rise to a height of more than 20 ft. and, flying with the wind, to fall on grassland 300–400 yards distant. Oviposition appears to take place from 1 to 3 hours after pairing. The female rarely lives longer than 12–14 hours.

Numerous experiments with various methods for the control of the eggs, larvae and adults are described. The control of the eggs or adults would appear practically impossible. In the larval stage a fair degree of control (about 75 per cent.) is economically possible by means of arsenical sprays, if the pasture is short and free from matted dead grass, etc. The most satisfactory spray tested consisted of 5–6 lb. lead arsenate powder to 100 gals. water. Spraying is likely to be most effective if carried out between the latter part of July and the early

part of September. Dusting, rolling, the use of poison baits, and top-dressing proved unsatisfactory.

The Carabid, *Promecoderus ovicollis*, Cast., is an important predator, but is not particularly abundant in the northern part of Tasmania. Birds, particularly the introduced starling, destroy an immense number of larvae and a certain number of adults. Bandicoots also destroy the adult and larval stages, but unfortunately appear to be comparatively scarce in the more closely settled districts. During seasons of exceptionally heavy rainfall thousands of grubs are drowned, but they are able to live for weeks in flooded burrows with only the head and thorax above water level. A fungus, apparently distinct from *Cordyceps gunnii* and *Isaria oncopterae*, the two species hitherto recorded as attacking *Oncopera*, was found commonly in one district from June to January destroying larvae and pupae.

The other important pests of pasture lands in Tasmania are a Noctuid, *Persectania ewingi*, Westw., and various species of Lamellicorn larvae, brief notes on which are given. Both pests, which are often associated with *Oncopera*, can be controlled by arsenicals directed primarily against the latter. *Porina fuscomaculata*, Wlk., was recently found abundance in a pasture in Victoria, causing damage to introduced fodder grasses that was hardly less serious than that caused by *O. intricata* in Tasmania. It would appear from investigations that the larval stage of this Hepialid is of much longer duration than that of *O. intricata*, but in certain stages and in their habits the two moths are very similar.

Staniland (L. N.). **A Survey of Strawberry Plantations in England (1926-28).**—*Rep. Agric. Hortic. Res. Sta. Bristol 1928*, pp. 42–59. Long Ashton, Bristol [1929].

An account is given of a survey of the strawberry plantations in England carried out during 1926–28 to determine the relative importance in the various districts of the chief abnormalities of strawberry plants. As a result of investigations these have been classified under six types, including " small leaf " and " sudden wilt," which are the result of root injury that may be due to attack by the larvae of various insects or to other causes, and " aphis plant," which results from the attacks of *Capitophorus fragariae*, Theo. (strawberry aphis) [*R.A.E.*, A, xvi, 54, 408]. This type occurs in all districts and is very common on those varieties of strawberry that are susceptible to Aphid attack. The symptoms are produced during the period from immediately after the picking of the fruit until the end of the autumn. In the spring the Aphids leave the affected plants and migrate to healthy ones. The plants attacked in the previous year are almost entirely free from Aphids for the remainder of their lives, a fact that seems to be due to the greatly increased starch content of the plant, which is probably the direct result of the infestation and renders the plant unsuitable for food. The migrations of the Aphids to healthy plants lead to a rapid spread of the malady, and with a serious infestation all the plants are affected in three years and the majority are dead. No egg stage has been observed, and it is concluded that the Aphid overwinters as a wingless viviparous female on strawberry. Experiments have shown that comparatively small numbers of Aphids are sufficient to produce the symptoms. Plants affected by Aphids produce excessive numbers of weak crowns, which grow relatively high in the air, such crowns

being formed in the year of attack. Developing roots on these plants, besides being weak, are produced at a point some distance above soil level, with the result that they cannot usually reach the soil before the tips are killed. The plant, having missed a root formation period, continues its life as a type of " small leaf " and dwindles gradually until it finally dies. The control methods recommended have already been noticed [xvi, 55]. It seems probable that similar symptoms may be caused by the attacks of *Tetranychus telarius*, L. (red spider).

TUTIN (F.). **The Preparation of a Pyrethrum Spray Fluid.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1928*, pp. 96–102, 4 refs. Long Ashton, Bristol [1929].

The specific toxic substances present in pyrethrum are insoluble in water but can all be removed from the powdered flowers by extraction with light petroleum, and as no preparation of these active principles suitable for use in the field appears to have been devised, experiments were undertaken with a view to bringing this extract into a form in which it could readily be emulsified and applied as a spray. Owing to the comparatively small yield of active product obtainable from the flowers and its high toxicity, it was decided to use a fatty oil, which would be relatively harmless to plants and capable of dissolving the active principle, as a diluent and " carrier." Rape oil was chosen, since it is also known to have a distinct value as a contact insecticide [*R.A.E.*, A, xv, 614]. Satisfactory emulsions of rape oil may be prepared by means of Agral WB or Agral I [*R.A.E.*, A, xvi, 585], and it was ascertained that this means may be used with equal facility for the emulsification of a rape oil solution of the active principles of pyrethrum. The pyrethrins have been shown to be esters and are therefore readily hydrolysed by means of alkalis, with the consequent loss of their insecticidal properties. This fact precludes the use of any alkali as an emulsifying agent, and it is probable that slow hydrolysis would occur in any hydrous emulsion containing pyrethrins even in the absence of free alkali. A solution of the crude pyrethrins in rape oil to which Agral WB has been added is free from these objections, as it contains neither water nor alkali, and it has been found to undergo no detectable decrease of activity on keeping for a number of months. In order to prepare an emulsion for spraying, the requisite amount of the solution is added to water when required for use and a very small amount of alkali then introduced. On shaking, an excellent emulsion is formed, which possesses high insecticidal properties and does not deteriorate too rapidly to be of practical use. After rather more than three weeks, however, such an emulsion becomes comparatively inactive.

To prepare the pyrethrum-rape oil spray liquid, a quantity (1,310 gms.) of coarsely ground air-dried Dalmatian flowers was extracted by continuous percolation with light petroleum (b.p. 30–40°). On evaporation, the resulting extract yielded a yellowish, sticky residue amounting to 18·73 gms., or 1·43 per cent. of the dried flowers employed. A portion of this material (2·86 gms.) was dissolved in 180 cc. rape oil and the resulting solution mixed with 22 cc. Agral WB. In order to emulsify this mixture for use as a spray, 1 cc. was added to 100 cc. water, 0·1 cc. aqueous 20 per cent. sodium hydroxide introduced, and the mixture well shaken. This emulsion would contain approximately 0·9 per cent. rape oil together with an amount of the pyrethrins corresponding to the presence of 1 per cent. of the original pyrethrum flowers in the emulsion.

The spray was tested against various beetles, the larvae of Lepidoptera and sawflies and *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.), and death resulted in all cases. Unsprayed beetles placed in a sprayed dish after the spray had dried also died; it is therefore evident that the active material remains effective for some days and that it is not essential for the insects to be drenched with spray. It did not apparently destroy the eggs of *Phyllodecta vulgatissima*, L., and at least two sprayings with an interval of about a week would therefore appear to be necessary to control this pest on willows. When living plants were sprayed, no damage was observed, even young leaves and flowers being apparently unaffected. Small scale trials with this mixture have been carried out in the field, and promising results have been obtained. The composition of the spray was slightly modified by increasing the concentration of Agral WB to obtain a good emulsion when the use of hard water was unavoidable. It was also thought advisable to increase the quantity of rape oil.

A comparison of English-grown pyrethrum with the Dalmatian product showed no noticeable difference in the insecticidal powers of the respective emulsions when they each represented the same weight of the original flowers or buds, although the weight of the petroleum extract from the English flowers was more than twice that obtained from the Dalmatian flowers.

Stanland (L. N.) & Walton (C. L.). **The Uses of Naphthalene for the Control of certain Pests of Market Gardens.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1928*, pp. 103–105, 1 ref. Long Ashton, Bristol [1929].

In the vicinity of Bristol a considerable area is devoted mainly to the growing of crucifers and celery, these two crops frequently alternating on the same land for considerable periods, with the result that certain of their more usual pests have attained serious proportions. The most important are *Psylliodes chrysocephala*, L., the larvae of which tunnel the stems of young cauliflowers, etc., *Ceuthorrhynchus pleurostigma*, Marsh., and *Phorbia* (*Chortophila*) *brassicae*, Bch. (cabbage root fly), all on *Brassica*; *Psila rosae*, F., and *Acidia heraclei*, L., on celery; and *Blaniulus* sp., on potatoes. During the period 1926–28 the chief losses were due to *P. chrysocephala*, which severely injured seed beds of crucifers, *P. rosae*, which attacked celery, chiefly when in the same stage, and to a less extent to *Blaniulus* sp. at one centre where potato crops had been grown for a number of years without a break.

The growers were recommended to use naphthalene (of a type suitable for broadcasting) as a repellent, making a series of light applications at the rate of 1 oz. per sq. yd. for the initial dressing and ½ oz. for the subsequent ones. In two localities it was found necessary to make six applications against *Psylliodes chrysocephala*, all prior to setting out the plants. For celery the number of dressings varied in the different localities from three to five, all made in the seedling or pricking out stages. For potatoes one application of 1 oz. per sq. yd. was made and dug in. *P. chrysocephala* was satisfactorily controlled; examination after setting out the plants revealed only a few infested cauliflowers out of several thousands. In one locality a severely infested seed bed was treated with naphthalene and at once replanted, and no infestation resulted. Up to the time of setting out,

Psila rosae had also been controlled, but on 13th November 1928 the celery then being dug for market had been attacked to a slight extent by the August brood after earthing up. This had resulted in some "rusting" of the outer green stems of otherwise fully developed and healthy plants. *Blaniulus* sp. was also controlled. In one locality, where a bed of young cauliflowers was destroyed by *Phorbia brassicae*, the crop was removed, and the ground treated with naphthalene and replanted immediately with cabbages, none of which showed signs of attack.

MAYNARD (J. G.). **The Economics of spraying Fruit Trees. I. The Cost of Winter Washing—Winter 1928-29.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1928*, pp. 124–137, 2 pls., 2 figs., 1 ref. Long Ashton, Bristol [1929].

Since little information is available as to the costs of spraying fruit trees, the figures obtained from spraying operations carried out during the winter of 1928–29 on a farm where conditions approximate those prevailing on many medium-sized commercial fruit farms are discussed. The lay-out of the farm and the spraying equipment are described in detail. The first table shows the dates of application, with particulars of the weather and the varieties of trees sprayed. The second gives details regarding the type of equipment used, the time taken, the amount of spray employed and the costs of spray, fuel for power sprayers, labour, etc. It is universally agreed that spraying is valuable, but the expense may not in all cases be economically justifiable, and the cost per tree for some of the plots is discussed from this point of view. A comparison of the figures obtained with knapsack and power spraying equipment seems to indicate that where any appreciable quantity of spraying is to be done, a good power machine not only gives greater pressure and speed of application, but in addition the actual cost of application per unit quantity of spray is appreciably less, thus justifying the very much heavier capital outlay.

GRASSÉ (P. P.). **Les noctuelles de la vigne.**—*Prog. agric. vitic.*, xci, no. 26, pp. 617–620, 1 pl. Montpellier, 30th June 1929.

Vines in the south of France were somewhat severely injured by insect pests during 1929, following a dry, cold winter. A short account is given of the more injurious Noctuids, *Feltia* (*Agrotis*) *exclamationis*, L., and *Euxoa* (*A.*) *segetum*, Schiff., with notes on the measures that may be employed against them.

ZOLOTAREWSKY (B.). **Note préliminaire sur les vols de sauterelles à Madagascar.**—*Rev. Path. vég. Ent. agric.*, xvi, no. 4–5, pp. 128–131. Paris, 1929.

The author records a number of observations made in Madagascar on the flight of *Locusta migratoria migratorioides*, Rch. & Frm. It is generally found that the invading swarms of locusts come from the plains of the south and south-west of the Island and fly towards the north, following the western coast. Doubtless this is partly due to the prevailing winds, but not entirely, for many of the flights from the south are directed to the north-east. Once, however, the flight is in progress, its behaviour is easily followed. Three factors determine its

course, namely, the tendency to continue in the direction first taken, the topography of the country and the direction and force of the wind. Continuance of direction is largely due to the gregariousness of locusts, but an observation of a large flight recorded in detail shows conclusively that the direction of a swarm is determined by the direction taken by the greatest mass of individuals composing it. In the case recorded, where two bands, one coming from south to north and the other from west to east, met and crossed, they continued as two bands in the same directions, but one was composed of the first band plus the head of the second, and the other of the second band plus the tail of the first. Examples of the influence of topography on direction are numerous in Madagascar, but this is nearly always combined with that of wind. The question of the influence of wind has been much discussed. In the author's opinion, while locusts tend to fly against the wind, when its force is greater than the velocity of the insects, it changes the course of the flight. In a strong wind, the locusts will make an abrupt deviation in order to seek a calm zone and will take advantage of any shelter, such as a cliff side.

Hansford (C. G.). **Cotton Diseases in Uganda, 1926-1928.**—*Emp. Cott. Grg. Rev.*, vi, nos. 1–3, pp. 10–22, 160–167, 240–245. London, 1929.

This review of the diseases of cotton in Uganda during the period 1926–28 includes studies of the part played by *Dysdercus* spp. in the transmission of internal boll rot (*Nematospora gossypii*), which probably causes greater loss to the crop than any other disease. The species of *Dysdercus* known to occur in Uganda are *D. nigrofasciatus*, Stål, *D. fasciatus*, Sign., *D. superstitiosus*, F., and *D. cardinalis*, Gerst.

In experiments in which bolls were sprayed with a suspension of *Nematospora* spores and examined after three weeks, all the sites of *Dysdercus* punctures, which had appeared on 50 per cent. of the bolls, were infected, but apart from these no infection occurred. Bolls similarly treated but protected from *Dysdercus* developed no infection, indicating that the fungus is unable to penetrate through uninjured boll walls. Bolls pricked over the surface with a needle both before and after spraying with the fungus developed no infection, but bolls sprayed and then pricked with a very fine needle penetrating the boll wall developed 45 per cent. infection, and bolls inoculated with *Nematospora* by means of a hypodermic syringe into the lock cavity gave 100 per cent. infection. From the evidence accumulated, which agrees with results previously secured by Laycock [*R.A.E.*, A, xiv, 320], it appears that infection only occurs when the boll is punctured, leaving a passage for the entry of the fungus into the lint cavity. It is not yet clear whether the fungus is able to grow through such a passage or must be actually introduced into the lint cavities, but the evidence indicates that the fungus cannot grow through the boll walls, even when these are superficially damaged. In further experiments, the stainers were placed on healthy bolls in bags for a period of 12–24 hours, and the bolls examined after an incubation period of 14–21 days. During the wet season of 1926–27 the percentage of infection in punctured bolls ranged from 75 to 100, whereas in 1927–28, when the weather was very dry, only 30 per cent. infection was obtained. Besides its effect in reducing infection, dry weather also reduces the number of stainers present in the cotton fields.

Apart from a very small percentage of bolls in which the infection begins from the base of the boll where the walls are thin and soft, *Nematospora* is practically never found in Uganda in bolls that do not show the puncture marks of *Dysdercus*. As no culture of *Nematospora* has been isolated from the external surface of cotton bolls in the course of repeated isolation series cultures, which revealed the presence of a large number of saprophytic fungi, it appears that *Dysdercus* actually transports the fungus from boll to boll. Evidence of the association of *Nematospora* with *Dysdercus* rather than with cotton is obtained from the known distribution of the fungus. In Uganda it has been found only in the interior of cotton bolls or seed, inside the seed of *Hibiscus esculentus* and of *Abutilon* sp., and inside the seed of avocado (*Persea gratissima*). With the exception of avocado, cases of *Nematospora* infection on plants other than cotton in Uganda have all been associated with infestation by *Dysdercus*.

The results of experiments carried out in 1928 in an attempt to elucidate the relation between the fungus and the stainers, using *Dysdercus nigrofasciatus*, are tabulated. They indicate that the insect does actually carry *Nematospora* from boll to boll, but the manner in which it orginally becomes infective and the method by which transmission is effected remain to be discovered. It appears possible that the insect feeds on a boll already infected and subsequently transfers spores of the fungus to a series of four or five bolls, by which time all spores remaining on the insect after its original feeding on the infected boll have been removed.

Internal proliferation of the boll walls is also the result of the punctures made by *Dysdercus*. Though infection with *Nematospora* is almost always associated with it, no organisms have been found in the wall tissues round the puncture or in the proliferated tissue. This affords additional evidence that the fungus does not grow through the minute aperture left by the rostrum of the insect, but is conveyed by it into the interior of the boll.

Balachowsky (A.). **Contribution à l'étude de la faune du Congo belge. Diaspines nuisibles au caféier et au cacaoyer.**—*Rev. Path. vég. Ent. agric.*, xvi, no. 4–5, pp. 141–145, 2 pls., 2 refs. Paris, 1929.

Aspidiotus gracilis, sp. n., is recorded as causing considerable injury by infesting the leaves of cacao in the Belgian Congo. *Diaspis boisduvali*, Sign., which attacks the leaves of coffee, has also been observed on palms in Kamerun, on coconut in Guadeloupe, and on ornamental species of *Cocos* in Algeria.

Balachowsky (A.). **Biologie d'*Hesperophanes fasciculatus*, Fald., Cérambycide nuisible au figuier cultivé en Afrique du nord.**—*Rev. Path. vég. Ent. agric.*, xvi, no. 4–5, pp. 156–159, 1 pl., 2 refs. Paris, 1929.

The Cerambycid, *Hesperophanes fasciculatus*, Fald., is widely distributed around the coast of the Mediterranean, where it lives in the wood of various wild and cultivated trees. In consequence of the frequent confusion of this species with the allied *H. griseus*, F., the characters of each are tabulated. In Algeria, *H. fasciculatus* is very injurious to figs, working generally in the wood of the current year, though older branches may be attacked. Oviposition occurs immedi-

ately after emergence throughout August; the eggs hatch shortly afterwards, and the larvae mine the branches, confining themselves at first to the sapwood and penetrating the heartwood in the winter. By the time the larvae are mature, about July, the galleries are nearly a foot long. The pupal stage lasts 2 or 3 weeks, the adult emerging by a circular hole through the bark. The branches attacked dry up and break off at the least wind, and in cases of severe infestation the tree bears no fruit and practically ceases growth. The only remedy is to cut out and burn the infested branches; this should be done preferably in winter when there is no foliage. In Algeria, *H. fasciculatus* is polyphagous, and attacks the living or dead wood of many trees, though *H. griseus*, which is much rarer, seems to be confined to figs.

Alfieri (A.). **Les méfaits et la biologie de l'***Oecia oecophila* **Staud. (Microlépid.-Gelechiadae).**—*Bull. Soc. R. ent. Egypte*, 1928, pp. 1–4, 1 pl. Cairo, 1929.

The food substances of certain insect larvae have frequently given cause for surprise, owing to their low nutritive value. A case is recorded of infestation of houses at Alexandria by *Oecia oecophila*, Staud., the larvae of which lived and matured in small holes that they had hollowed out in the plaster of the walls and covered by a light blister formed of plaster dust held together by the larval salivary secretions. Eggs were deposited on the plaster and on the blisters. The plaster was analysed and was found to contain no starch or other organic matter.

Alfieri (A.). **The Introduction of a Parasite (*Microbracon kirkpatricki* Wilk.) of the Pink Boll Worm into Egypt.**—*Bull. Soc. R. ent. Egypte*, 1928, pp. 52–56. Cairo, 1929.

Details are given of the introduction of the Braconid, *Microbracon kirkpatricki*, Wilkn., from Kenya, where it is an efficient parasite of *Platyedra* (*Gelechia*) *gossypiella*, Saund. (pink bollworm), into Egypt. Most of the parasitised bollworms were found to occur in green half-opened bolls; 10–12 per cent. of these bolls contained parasitised material, an average of 4 parasites emerging from each. The bolls were therefore despatched without examination and kept in cold storage on board ship. A temperature of 5–8° C. [41–46·4° F.] was the optimum, as it did not affect the parasite larvae or adults and sufficiently preserved the bolls from decomposition. Altogether, 470 adult parasites were obtained in Egypt from 3,450 cotton bolls. During the preliminary investigations in Kenya, *P. gossypiella* was found in bolls of *Hibiscus furcatus*, this being the first time it has been recorded in a malvaceous plant other than cotton in Kenya.

Trehan (K. N.). **Life-history, Bionomics and Control of *Myllocerus maculosus*, Desb. (Curculionidae: Coleoptera).**—*Bull. Agric. Res. Inst. Pusa*, no. 181, 28 pp., 5 pls., 9 figs., 16 refs. Calcutta, 1929.

The weevil, *Myllocerus undecimpustulatus* var. *maculosus*, Desb., which was first observed damaging Egyptian cotton at Cawnpore in 1895, is widely distributed throughout India, where it attacks a variety of plants and is likely to attain the status of a major pest of cotton if its increase remains unchecked. The adult feeds on the foliage, and

the larva injures the roots of cotton plants. A list of the 19 food-plants on which this weevil has been recorded in India is given, and all its stages are described. The eggs are laid in batches, one female having been observed to lay as many as 361 in captivity, and maximum hatching occurs between the second week of June and the middle of July. The incubation period occupies 3–5 days in summer and a week in autumn, the larva matures in 31 days under natural conditions, and the pupal stage, which is passed in an earthen cell at a depth of 1–3 inches in the soil, lasts about a week.

The first brood of adults usually appears about the end of April and feeds on the ratoon crop, the maximum infestation occurring at Lyallpur in the second or third week in June. There are at least 5 generations in a year, hibernation occurring in the larval stage in the soil below a depth of 3 inches. The examination of over 1,000 plants indicated that desi cotton, which in some cases suffers very severely, is appreciably more susceptible to attack than the American varieties. Damage by the adults is not very severe when confined to the foliage, but buds, flowers and young bolls are also attacked. A newly hatched larva was observed to kill a cotton seedling in 6 days, and its feeding capacity probably increases with age, so that severe losses are likely to occur where germinating crops are attacked. Examination of soil from cotton fields to determine the depth to which the larvae can penetrate showed that the older stages predominate in the upper 3 inches, below which the younger stages were more numerous. In deeper layers down to 8 inches only the least developed larvae were found, but it was observed that the larvae go even deeper for hibernation and can reach a depth of 12 inches. A Braconid parasite (? *Loxocephalus* sp.), the larvae and pupae of which are described, has been bred from the adult weevils and is the first parasite recorded from this host. After leaving the host it spins a cocoon; from cocoons spun in December, the adults emerged in 19–21 days. Two cases of Nematodes parasitising the larvae, which died before pupation, have been observed at Pusa.

Experiments with three varieties of trap crops gave satisfactory results in the case of *Cajanus indicus* when sown earlier than cotton and between the rows. The weevils of the first brood are attracted to the trap crop and can then be killed by shaking the plants over pans of water with a film of kerosene or by the use of an insecticide. Intercultivation disturbs the stages to be found in the soil, and ploughing after the crop is over is a necessity. Spraying with lead arsenate, 1 lb. in 25 gals. water, and dusting with Paris green, 1 : 8, have proved effective against the adults, but are very expensive.

MISRA (C. S.). **The Cultivation of Lac in the Plains of India** (*Laccifer lacca*, **Kerr**).—*Bull. Pusa Agric. Res. Inst.*, no. 185, 116 pp., 29 pls., 35 figs. Calcutta, 1929. Price, *Rs.* 4 or 6*s.* 9*d.*

This bulletin is the revised (fourth) edition of one first published in 1912, of which the third edition has been noticed [*R.A.E.*, A, xi, 438]. It includes all the latest information regarding *Laccifer lacca*, Kerr, and the practical methods of cultivating it. The list of its food-plants is considerably extended, though the amount of lac produced on most of them is at present too small to be used commercially. If lac production can be carried on as a cottage industry on co-operative

lines, the output of crude lac will be considerably increased, and a more regular supply would prevent the ousting of the natural product by synthetic lac.

Jepson (F. P.). **The Termite-proof Construction of Buildings in Ceylon.**—*Bull. Dept. Agric. Ceylon*, no. 85, 36 pp., 26 pls., 10 refs. Colombo, March 1929.

Much damage is done by termites to buildings in Ceylon, where practically no measures are taken to exclude them. The author gives a general account of termites and their habits and of the damage done by them. Over 50 species have been recorded from Ceylon, and many are still unidentified. The most important species where buildings are concerned are *Calotermes* (*Cryptotermes*) *domesticus*, Hav., and another species of *Calotermes*, *Coptotermes ceylonicus*, Holmgr., *Termes* (*Odontotermes*) *ceylonicus*, Wasm., *T.*(*O.*) *obscuriceps*, Wasm., *T.* (*O.*) *redemanni* Wasm., and *Leucotermes ceylonicus*, Holmgr. Quite recently *T.* (*O.*) *horni*, Wasm., has also been observed damaging buildings. Of these, the two species of *Calotermes* are the only ones that build their nests above ground, generally in dry wood; the others, with the possible exception of *Coptotermes ceylonicus*, nest only in the soil. *C. ceylonicus* has been found destroying living tea bushes, wooden roof timbers and walls and logs on the ground, but it is not known whether the wood was entered by winged individuals or by means of communication with an underground nest. *Termes* spp. are the common mound-building termites of Ceylon, but apparently do not occur in mountainous parts of the Island where rainfall is excessive; they are more frequently found in buildings than any other species. *L. ceylonicus* occurs only at low elevations, but is troublesome in buildings. The two species of *Calotermes* are less injurious.

The most satisfactory method of treating termite nests in the ground is fumigation with arsenic and sulphur or with calcium cyanide. The nests of *Termes* spp., which build mounds, can be treated by introducing Paris green, potassium or calcium cyanide or petrol into them. Carbon bisulphide is effective but expensive. The use of sweetened poison baits in the nests is promising and deserves further attention. For very large nests, explosives such as gelignite and dynamite are recommended. The selection of suitable timbers for construction is discussed, and it is suggested that the introduction into Ceylon for afforestation purposes of certain exotic termite-proof trees and the extension of certain indigenous species with termite-resisting properties would be an advantage. Where imported timber or metal cannot be used for buildings, the treatment of local non-immune varieties of wood in various ways, such as impregnation with coal-tar creosote, is suggested [*R.A.E.*, A, xii, 441; xiv, 409]. Against the subterranean species of termites, the construction of termite-proof buildings is the only permanent remedy, the fundamental principle being the complete insulation of the superstructure from the foundation and the ground by means of a termite-proof barrier. The author suggests many applications of this principle, which are tentative and may require modifications, and discusses certain types of buildings to which termite-proof measures are not applicable. In appendices are included lists of Ceylon timbers considered in their relation to termite attack and a suggested list of Ceylon timbers that might be considered suitable for impregnation.

PAPERS NOTICED BY TITLE ONLY.

MORSTATT (H.). **Bibliographie der Pflanzenschutzliteratur. Das Jahr 1928.** [A Bibliography of Plant Protection Literature in 1928.]—*Biol. Reichsanst. Land- u. Forstw.*, iv+251 pp., Berlin, P. Parey; J. Springer, 1929. [*Cf. R.A.E.*, A, ix, 445, etc.]

HUKKINEN (Y.). **Ein neuer Stäubeapparat: Der Feldpflanzenverstäuber "Puhuri."** [A new Duster. The Field Plant Duster "Puhuri."]—*Anz. Schädlingsk.*, v, no. 5, pp. 53–55, 3 figs. Berlin, 15th May 1929. [*Cf. R.A.E.*, A, xvi, 594.]

STANILAND (L. N.) & WALTON (C. L.). **The Long Ashton Tar Distillate Wash: Field Experiments, 1927-28.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1928*, pp. 87–95, 2 diagr., 15 refs. Long Ashton, Bristol. [1929.] [*Cf. R.A.E.*, A, xvii, 120.]

HOLLAND (E. B.) & GILLIGAN (G. M.). **Electrolytic Apparatus for the Determination of Copper in Insecticides and Fungicides.**—*Indust. & Engng. Chem.*, xx, no. 5, p. 533, 1 fig. Easton, Pa., May 1928.

KINOSHITA (S.) & ONOE (T.). **Results of Experiments on the Effectiveness of Insecticides sold in Tokyo in 1927.** [*In Japanese.*]—*J. Imp. Agric. Expt. Sta.*, i, no. 1, pp. 91–95. Nishigahara, Tokyo, March 1929.

KISHIDA (K.). *Erythraeus ojimai*, **sp. n., parasitic on the Larvae of** *Chilo simplex*. [*In Japanese.*]—*J. Imp. Agric. Expt. Sta.*, i, no. 1, pp. 96–100, 1 pl. Nishigahara, Tokyo, March 1929.

HAZELHOFF (E. H.). **Biological Control of** *Oregma lanigera* **in Java** [by means of *Encarsia flavoscutellum*, Zehnt.]. **Determining the Damage done to Sugar Cane in Java by the White Top-borer** [*Scirpophaga intacta*, Sn.] **and the Striped Stalk-borer** [*Diatraea venosata*, Wlk. (*striatalis*, Sn.)]. **Mechanical Control of the White Top-borer of Sugar Cane in Java.**—*Proc. 3rd Conf. Internat. Soc. Sugar Cane Technol.*, reprint 8 pp. Surabaya, Java, 1929. [*Cf. R.A.E.*, A, xvii, 233, 422, etc.]

MASSEE (A. M.). **The Black Currant Gall Mite** [*Eriophyes ribis*, Nal.] **on Red Currants.**—*Rep. East Malling Res. Sta. 1928*, xvi, pt. 1 (general), pp. 123–124. East Malling, Kent, April 1929. [See *R.A.E.*, A, xvii, 324.]

COULON (L.). **Les espèces françaises du genre** *Apion* **Herbst du Musée d'Elbeuf, avec notes biologiques.**—*Bull. Soc. Etude Sci. nat. Elbeuf*, xlvii (1928), pp. 81–95. Elbeuf, 1929.

LAING (F.). **Report on Australian Coccidae** [including 15 new species and 1 new variety].—*Bull. Ent. Res.*, xx, pt. 1, pp. 15–37, 23 figs. London, May 1929.

STEINWEDEN (J. B.). **Bases for the generic Classification of the Coccoid Family Coccidae.**—*Ann. Ent. Soc. Amer.*, xxii, no. 2, pp. 197–245, 2 pls., 6 figs., 10 refs. Columbus, Ohio, June 1929.

MAXSON (A. C.) & KNOWLTON (G. F.). **The Tribe Pemphigini (Aphididae) in Utah.**—*Ann. Ent. Soc. Amer.*, xxii, no. 2, pp. 251–271, 8 figs. Columbus, Ohio, June 1929.

PAILLOT (A.). **Sur l'origine infectieuse des micro-organismes des Aphides.**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 4, pp. 210–213, 2 figs., 1 ref. Paris, 1929.

STOCKDALE (F. A.) & DRIEBERG (J. C.). **Cardamom** (*Elettaria cardamomum* **Maton**).—*Leafl. Dept. Agric. Ceylon*, no. 56, 4 pp. Also in *Trop. Agriculturist*, lxxii, no. 3, pp. 166–169. Peradeniya, March 1929.

Cardamoms are attacked in Ceylon by *Lampides elpis*, Godt. (cardamom borer), which lays its eggs in the flowers. The larvae of this butterfly feed on the flowers and seeds, and pupation takes place in the fruit. The adults emerge through a small hole in the empty capsule.

LIGHT (S. S.). **Biological Control in Entomology with special Reference to Pests of Tea.**—*Tea Quarterly, J. Tea Res. Inst. Ceylon*, ii, pt. 2, pp. 73–80. Nuwara Eliya, May 1929.

This discussion of the importance of native and introduced parasites and predators in controlling insect pests includes brief notes on some of the parasites that attack tea pests in nature in the Dutch East Indies and Ceylon. The Ichneumonid, *Phytodietus capuae*, Morl., has been observed to produce a fair degree of parasitism in the tea tortrix [*Homona coffearia*, Nietn.] in Ceylon, but in general this moth, though attacked by a variety of parasites, is not appreciably checked by them. Reference is made to the difficulty of propagating the native parasite, *Trichogramma erosicornis*, Westw., for the purpose of controlling it [*R.A.E.*, A, xvi, 4 ; xvii, 414], and to the possibility that better results might be obtained by importing from America the allied species, *T. minutum*, Riley.

MYERS (J. G.). **The Principles of Biological Control.**—*Trop. Agriculture*, vi, no. 6, pp. 163–165. Trinidad, June 1929.

The author limits the term biological control to the utilisation of one kind of organism for the destruction of another and tabulates the various attempts that have been made in biological control of animals by other animals and by plants (including fungi and bacteria), and also of injurious plants by insects, etc., but points out that, with regard to their relative practicability, all of these are either in the experimental stage or may be dismissed as valueless, except that of the control of insects and other Arthropods by insects. The introduction of predacious birds and mammals is condemned as dangerous, though bird protection should be encouraged as a general precaution against insect outbreaks. It is significant that all the outstanding successes in biological control have been won with introduced parasites, whereas the attempted encouragement of native ones has generally proved ineffective. The most favourable circumstances, as instanced in Hawaii, appear to be that the pest to be controlled is an immigrant, introduced without its natural enemies ; that the indigenous fauna is limited, so that the chances of insect enemies occurring are small ; that the climate is warm and equable and therefore favourable to introduced parasites ; and that only a few main crops are grown, so that high organisation and centralisation are possible. Probably the most unfavourable regions in which to attempt biological control are the continental areas, and in such places it is frequently necessary to breed the parasite continually in the laboratory for periodical distribution.

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Hazelhoff (E. H.). **Insect Pests of Sugar Cane in Java.**—*Proc. 3rd Conf. Internat. Soc. Sugar Cane Technol.*, reprint 8 pp. Surabaya, Java, 1929.

This is a list of 131 insects that have been recorded as feeding on sugar-cane in Java, with brief notes on the importance and control of a few of them.

Kawada (A.) & Yendo (T.). **Notes on** *Cochlidion dentatus*, **Oberth.** [*In Japanese.*]—*Kontyû*, iii, no. 1, pp. 33–36, 1 pl. Tokyo, March 1929.

The Limacodid, *Heterogenea* (*Cochlidion*) *dentata*, Oberth., has two generations a year in Japan, the adults appearing from the end of June to the middle of July and again in August. The larvae feed on plum, pear, willow, oak and chestnut. The winter is probably passed in the larval stage in the cocoon.

Sonan (J.). *Brachymeria obscurata*, **Wlk., as a primary or secondary Parasite.** [*In Japanese.*]—*Kontyû*, iii, no. 1, p. 40. Tokyo, March 1929.

In Formosa, the Chalcid, *Brachymeria obscurata*, Wlk., parasitises the larvae of *Homona menciana*, Wlk., *Adoxophyes privatana*, Wlk., *Perina nuda*, F., and *Lymantria* (*Porthetria*) *obsoleta*, Wlk., and the pupae of *Henicospilus striatus*, Cam., which is itself parasitic on the larvae of *Notolophus posticus*, Wlk.

Teranishi (T.). **Ants found in Dwelling-houses in Loochoo.** [*In Japanese.*]—*Kontyû*, iii, no. 1, pp. 41–42. Tokyo, March 1929.

The ants found in dwelling-houses in the Loochoo Islands are *Pheidole* sp., *Monomorium pharaonis*, L., *M. floricola*, Jerd., *M. latinode*, Mayr, *Tapinoma melanocephalum*, F., *Iridomyrmex glaber*, Mayr, *Plagiolepis longipes*, Jerd., *Paratrechina longicornis*, Latr., and *P. bourbonica bengalensis*, Forel.

Yuasa (H.). **Notes on the Japanese Chrysomelidae. II.** [*In Japanese.*]—*Kontyû*, iii, no. 1, pp. 43–46. Tokyo, March 1929.

In this continued paper [*cf. R.A.E.*, A, xvi, 53], *Psylliodes angusticollis*, Baly, is recorded on egg-plant and potato, *P. punctifrons*, Baly, on crucifers, and *P. japonica*, Jac., on hops and hemp.

Tokuda (Y.). **The Honey Bee. Vol. 1.** [*In Japanese.*]—379 pp. Maruzen & Co., Tokyo, May 1928. Price, *Yen* 3·90.

This book, which is written from a practical standpoint, includes a history of apiculture in Japan. The insect enemies of the honey bee include the wax-moths, *Galleria mellonella*, L., and *Achroia grisella*, F., the adults of which appear in spring and again in summer and early autumn, and *Vespa mandarinia*, Smith, which attacks and kills the bees.

"Neoton." What it means to Agriculturists.—12 pp. Tokyo, Inst. Phys. Chem. Res. [1929].

This pamphlet describes a proprietary insecticide prepared from rotenon, the active principle of derris root. As rotenon is insoluble in water, an oil of high unsaturated fatty acid content is used for dissolving it, and this adds to the insecticidal power of the product. The oil solution, which is stable, is made into a soap emulsion before use, the alkalinity of the soap being neutralised by the fatty acids of the oil. Reports of several Agricultural Experiment Stations of the successful use of this insecticide against a great variety of insects are appended.

STRAND (E.). **Zoological and palaeontological nomenclatorical Notes.**—*Acta Univ. Latviensis*, xx, pp. 1–29. Riga, 1929.

The author gives names to eight species of Aphids that were described, but not named, by Takahashi in "Aphididae of Formosa," pt. 4 [*R.A.E.*, A, xiii, 547].

NAKAYAMA (S.). **Studies on the Natural Enemies of the Corn Borer.** [*In Japanese.*]—*Ann. Agric. Expt. Sta. Chosen*, iv, no. 2, pp. 95–98, 1 fig. Suigen, Korea, April 1929.

Pyrausta nubilalis, Hb., is very destructive to maize, Italian millet [*Setaria italica*], *Sorghum*, hemp, etc., in Korea. The Tachinid, *Lydella senilis*, Mg. (*Ceromasia lepida*, auct.), a description of which is given, is a parasite of this moth, the adults being abundant in July and August near Suigen. The eggs are laid on the body of the host larva, in which the parasite feeds until it leaves it to pupate. Two Hymenopterous parasites also attack *P. nubilalis*.

EASTHAM (L. E. S.). **The post-embryonic Development of *Phaenoserphus viator* Hal. (Proctotrypoidea), a Parasite of the Larva of *Pterostichus niger* (Carabidae), with Notes on the Anatomy of the Larva.**—*Parasitology*, xxi, no. 1–2, pp. 1–21, 3 pls., 1 fig., 48 refs. Cambridge, May 1929.

The literature on parasites of the family PROCTOTRUPIDAE, sens. strict., the hosts of which are chiefly to be found among Diptera and Coleoptera, is discussed, and lists of the species hitherto bred from various hosts are given. With one exception [*R.A.E.*, A, xiii, 68], these refer only to chance discoveries in the course of other work and consist of little more than a mere statement of the parasitism. A detailed study was therefore made of *Phaenoserphus viator*, Hal., found in various parts of England parasitising the larvae of the Carabid, *Pterostichus niger*, Schall. Although it was never observed to oviposit in the larva of *P. niger*, measurements of the larval instars clearly indicate that the life-history is annual. The adults emerge in August and September and can be found visiting flowers or searching the upper layers of the soil. The larval life lasts till about the middle of August, and is followed by a pre-pupal stage of about 10 days and a pupal stage of 2 weeks' duration. Four larval instars have been found endoparasitic in the host larva. At the end of the last instar, the parasites, which may number as many as 45 in a single host, emerge, and while still attached, pupate without spinning a cocoon. Between October and March little growth is made by the parasite larvae. This

was at first assumed to be due to the hibernation of both host and parasite, but it may be a result of the asthenia exhibited by parasite larvae, which Roubaud considers to be due to the parasitic association in which the host's blood is sufficiently toxic, by reason of its contained excretory matter, to keep the early stages of the parasite in a state of asphyxia. The host larvae lead an active life during April, when the contained parasites begin to grow rapidly. During May the host larva becomes sluggish and by June shows distinct signs of being parasitised.

The effect of the parasite in inhibiting the metamorphosis of the host is discussed, and the anatomy of the larvae at various stages is described.

THOMPSON (W. R.). **On the Effect of random Oviposition on the Action of entomophagous Parasites as Agents of natural Control.**—*Parasitology*, xxi, no. 1–2, pp. 180–188, 1 ref. Cambridge, May 1929.

This paper is the continuation of a study previously noticed [*R.A.E.*, A, xiv, 568]. Starting with the hypothesis that not more than one parasite can develop in a single host, it is shown by means of mathematical formulae that, if the reproductive rate of the parasite is decidedly greater than that of the host (*e.g.*, 1·5 times as great), superparasitism will not necessarily produce any marked retardation of the process of control in cases where control within a reasonable time would otherwise be probable.

BUISSON (E. M.). **Contribution à l'étude monographique et biologique des pucerons des arbres fruitiers du Bourbonnais.**—*Rev. sci. Bourbonnais*, 1929, no. 1, pp. 3–16, 10 refs. Moulins, April 1929.

Brief descriptions are given of the commoner Aphids occurring on fruit trees in the central region of France, together with short biological notes.

ATANASOFF (D.). **Mosaic Disease of Flower Bulb Plants.**—*Bull. Soc. bot. Bulgarie*, ii, pp. 51–60, 3 pls., 21 refs. Sofia, 1928.

Investigating the method of transmission of mosaic disease of bulb plants, the author obtained inconclusive results in the case of Aphids, which were not observed on hyacinth or narcissus. He concludes that, while the natural vector of mosaic of tulips may be an Aphid, the agents in the case of hyacinth and narcissus must be some other insect.

RIPPER (W.). **Ein Massenauftreten von** *Tydeus croceus* **L., an Roggenähren.** [A Mass Occurrence of *T. croceus* on Ears of Rye.]—*Z. PflKrankh.*, xxxix, no. 5, pp. 180–183, 3 figs., 3 refs. Stuttgart, May 1929.

In September 1928, normal, mature ears of rye sent to Vienna from Lower Austria for examination were infested by small reddish mites, identified as the Eupodid, *Tydeus croceus*, L. The mites occurred for about a month, and were found in large numbers in the barns where the crop was stored. No apparent injury to the ears was caused.

GOURLAY (E. S.). **The Apple Beetle** (*Doticus pestilens* **Olliff**) **in New Zealand.**—*N.Z. J. Sci. Tech.*, x, no. 6, pp. 369–370, 2 figs., 4 refs. Wellington, N.Z., April 1929.

Studies in Australia [*R.A.E.*, A, xii, 90, etc.] have shown that the Anthribid, *Doticus pestilens*, Olliff, formerly regarded as a pest of apples, does not breed in living tissue, but confines its attention to dead or dying fruit. Galls of the rust fungus, *Uromycladium notabile*, collected in New Zealand on *Acacia decurrens* in the winter, were found to contain larvae of the beetle, and adults were sheltering, apparently in hibernation, in the galls. The larvae consume the inside of the gall, pupating in September and October, and successive generations may occur throughout the season in the constantly recurring young galls. These galls probably provide the natural food of the beetle, infestation of dried apples and other fruit being only a secondary development. On an apple tree within three yards of a large area of *Acacia* heavily infested with galls containing *D. pestilens*, only a very small percentage of dried apples containing immature stages of the beetle were found.

MUGGERIDGE (J.). **Biological Control of Pear-midge** (*Perrisia pyri*) **in New Zealand.**—*N.Z. J. Agric.*, xxxviii, no. 5, pp. 317–320, 1 fig., 8 refs. Wellington, 20th May 1929.

Notes are given on the results of the colonisation of *Misocyclops marchali*, Kieff., in New Zealand for the control of the pear midge, *Dasyneura* (*Perrisia*) *pyri*, Bch. Though the parasite had survived two or three winters, it did not exercise the degree of control that was hoped for in 1928–29, even in the orchard where the main liberation had taken place. It is therefore intended to introduce other natural enemies, such as *Pilophorus perplexus*, D. & S., and *Torymus abbreviatus*, Boh.

SNYDER (T. E.). **Termite Control in the Gulf States.**—*Quart. Bull. Pl. Bd. Mississippi*, ix, no. 1, pp. 1–19, 11 figs., 3 refs. A. & M. College, Miss., April 1929.

This is a somewhat popular account of termites and their control in the southern United States, with particular reference to the infestation of buildings and timber by them. Most of the information given has already been noticed [*R.A.E.*, A, x, 192; xii, 441; xiii, 277; xiv, 409; xv, 287, 437].

HALLOCK (H. C.). **Notes on Methods of rearing Sarcophaginae (Diptera), and the Biology of** *Sarcophaga latisterna* **Park.**—*Ann. Ent. Soc. Amer.*, xxii, no. 2, pp. 246–250, 6 figs., 5 refs. Columbus, Ohio, June 1929.

A study has been made of the habits and distinctive larval characters of Sarcophagine flies. Adult females were captured in the field and kept separately in cages for 4 or 5 days with 10 per cent. honey solution for food, but in many cases the gravid females would not larviposit on freshly killed insects in the cages. The larvae were then dissected from them and placed on freshly killed larvae of *Popillia japonica*, Newm., and if the species was one accustomed to feeding on insect tissue in the larval stage, the maggots fed rapidly and developed normally. The progeny of each fly was kept in a cage within a large cage, special

precautions being taken to prevent outside contamination by larvae of Muscoid flies, and the larval food, placed in the centre of the inner cage, was kept in a tin can with sides nearly 2 in. high.

Large numbers of *Sarcophaga latisterna*, Parker, were observed flying round larvae of *Anisota* sp. that had been feeding on oak leaves. Both living and dead larvae were very attractive to them, but *S. latisterna* was not reared as a parasite of this moth. The closely related *S. cimbicis*, Towns., was reared from adults of the Dynastid, *Xyloryctes satyrus*, F. Larvae of *S. latisterna* dissected from adults developed rapidly on larvae of *P. japonica*, and after feeding for 4 or 5 days, wandered away from their food and pupated in the soil of the cage, where they remained for a month. Larvae of *S. bullata*, Parker, on the other hand, took 11 days to develop.

The first and third instar larvae of *S. latisterna* are described, with notes on the puparium. It has been reared by other authors from *Pieris* (*Pontia*) *rapae*, L., and *Heliothis obsoleta*, F., and it is probable that its habits and those of allied species are plastic. Though they often develop as scavengers, they may be true parasites in some cases; it is possible that the parasitic habit is in process of development.

Cook (W. C.). **A bioclimatic Zonation for studying the Distribution of injurious Insects.**—*Ecology*, x, no. 3, pp. 282–293, 3 figs., 7 refs. Brooklyn, N.Y., July 1929.

The following is the author's summary :—

In considering the relations of climate to the distribution and abundance of economic insects, it is necessary to restrict the study to those regions in which outbreaks may occur. The insect may be captured in other places, but such captures indicate the presence of physiographic or edaphic variations, and cannot be correlated with climatic conditions. Within the area of economic distribution of the species it is possible to recognise three gradations of abundance and destructiveness, which may be correlated with climatic conditions. This makes it possible to define three bioclimatic zones for the species. In certain regions the insect is well adapted to the normal climate, and would cause outbreaks every year, if it were not controlled by variations from the normal climate. Climatic extremes, which would wipe out the population, are either absent, or very rare and local. In this zone the insect is controlled largely by its insect parasites. The zone so defined may be called the zone of normal outbreak conditions. In regions adjacent to the normal zone the insect is not adapted to the normal climate, but to variations from the normal, and outbreaks follow these variations. Severe extremes, which almost wipe out the population, occur at frequent intervals, but a permanent population is maintained, which can serve as a nucleus for an outbreak when conditions become favourable. In this zone parasites are of less importance, and outbreaks are frequently checked by fungous and bacterial diseases. This may be called a zone of occasional outbreaks. In regions still further removed from normal conditions for the insect, a permanent population is not maintained, but outbreaks caused by migrants may follow outbreaks in the inner zones. These outbreaks are controlled directly by climatic extremes, or indirectly by fungous and bacterial diseases. This outer zone may be termed a zone of possible outbreaks. In the outer zones, parasites may be of importance, but they must be forms having other hosts which are adapted to the climate of these regions. The specific

parasites of the insect will rarely, or never, follow it to the extremes of distribution. These three zones are definitely correlated with climatic conditions, and, if the critical climatic conditions are known, it will be possible to set definite criteria for their limits, based upon the probability of occurrence of favourable or unfavourable conditions. This has been done for the pale western cutworm [*Porosagrotis orthogonia*, Morr.] in another study, part of which is presented in abstract [*R.A.E.*, A, xvii, 229].

Van Leeuwen (E. R.). **Life History of the Codling Moth in Northern Georgia.**—*Tech. Bull. U.S. Dept. Agric.*, no. 90, 94 pp., 21 figs. Washington, D.C., June 1929.

A very detailed account is given of the life-history and habits of *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) as observed in northern Georgia in 1920 and 1921, no studies having previously been made on this pest in any district so far south. In 1920 the pupation of the overwintering larvae began on 24th March, and the first moths emerged on 20th April ; in 1921 the corresponding dates were 4th and 23rd March. The first generation from the deposition of the first eggs until the emergence of the last moths covered the period from 6th May to 31st July in 1920, and from 13th April to 11th August in 1921 ; the second generation from 23rd June to 26th September in 1920, and from 8th June to 9th September in 1921 ; and the third generation from 30th July to 1st November in 1920, and from 15th July to 3rd October in 1921. In 1920 98·66 per cent. of the larvae of the third generation overwintered, and of the moths that emerged only one oviposited and the eggs were infertile. In 1921 the first eggs of the fourth generation were laid on 21st August, and 96·31 per cent. of the resulting larvae overwintered ; the first moth from eight larvae that pupated emerged on 5th October. The studies were then discontinued, but it is believed that if the moths of the fourth generation had been observed, a fifth generation would have been recorded and that the eggs would have hatched about the time that late varieties of apples were being harvested. Only a few fourth generation larvae transformed in the insectary, but it is probable that hundreds of moths emerged in the field.

Insect parasites play an important part in controlling *C. pomonella* in this district, *Exorista ochracea*, Wulp, and *Ascogaster carpocapsae*, Vier., being the two observed, and the rate of parasitism amounting to 10·16 per cent. in 1920. *Tenebroides corticalis*, Melsh., which is one of the most important predators, was observed to capture the full-grown larvae and also to break down the cocoons. Larvae of Chrysopids were often seen devouring the contents of the eggs, one larva being able to destroy as many as 50. Spiders were observed feeding on the full-grown larvae beneath burlap bands, and ants were also found feeding on them.

The majority of the moths emerge between 10 a.m. and 3 p.m. Where rough scales of bark were removed from the trunk of the tree and a burlap band substituted, only 20 per cent. of the larvae spun up beneath the band. The average number of eggs laid by each female is lower for the spring brood than for the subsequent generations. The fecundity of *C. pomonella* in Georgia is high, and this fact together with the number of generations in a season accounts for its abundance.

The same conditions that influence the growth of the apple tree affect the development of the moth, and although calendar dates cannot be depended on, certain periods after the fall of the apple blossom petals can be used to determine the proper dates for spraying. On account of seasonal variations, band-records should be made to determine the dates of emergence of the moths of separate generations. From the observations recorded in this paper, the treatment recommended for medium infestations consists of a calyx spray after 90 per cent. of the petals have fallen and five cover sprays applied, 2, 4, 8–9, 10, and 12–14 weeks after the fall of the petals. The calyx spray is the most important; the third and fourth cover sprays are against the second brood larvae, and the fifth against the third brood. In cases where the control of the earlier broods has not been maintained, it may be necessary to apply a later spray, but care should be taken to remove any excess arsenical residue from sprays applied late in the season.

Riley (H. K.). **The Greenhouse Centipede.**—*Bull. Purdue Univ. Agric. Expt. Sta.*, no. 331, 14 pp., 6 figs. Lafayette, Ind., March 1929.

An account is given of the Symphylid, *Scutigerella immaculata*, Newp. (greenhouse centipede), which is an important pest in vegetable greenhouses in Indiana, where some growers of lettuce report very heavy losses. Much of the information has been noticed elsewhere [*R.A.E.*, A, xvi, 123, 518]. Reproduction in Indiana is most active in the summer months, eggs being found in small clusters in cracks in the subsoil of greenhouses from April to September. Hatching occurs in a week or ten days, and the life-cycle extends over several months, reproduction continuing at a reduced rate during the remainder of the year. In early autumn, when the soil is watered and the crops planted, the Symphylids migrate to near the surface and begin to feed on plant roots; during summer the food is largely decaying vegetable matter. The use of barriers [xvi, 518] proved ineffective, the Symphylids working their way through them after a few weeks. Insecticides and heat treatment were both unsuccessful, as the Symphylids were apparently able to migrate below the point reached by them sufficiently to maintain infestation. Soil fumigation with carbon bisulphide, however, gave good results. Where steam sterilisation is practised, carbon bisulphide should be mixed with steam by pumping it through a ½-inch pipe into the main steam line and injected into the soil under steam pressure, using 1 oz. of carbon bisulphide to each square foot of surface. Where there are no steam tiles, hand injections, with pipe and funnel, have proved effective. The soil temperature should be above 65° F., and treatments should be made in early autumn, before the first crop is planted. As supplementary measures, thorough and deep cultivation of soil in ground beds should be regularly practised. All soil and manure brought into greenhouses should be obtained from an uninfested source or should be steam sterilised before entrance.

Rohwer (S. A.). **A Note on the Synonymy of a Birch Leaf Miner.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 3, pp. 62–63. Washington, D.C., March 1929.

The leaves of birches in parts of Maine and Canada have been considerably damaged in recent years by a sawfly that is not native to

America but was described by MacGillivray as *Phlebatrophia mathesoni*, gen. et sp. n., in 1909. The author is convinced, however, that this species is identical with the European *Phyllotoma nemorata*, Fall., and considers that the few structural differences between it and *P. vagans*, Fall., the type of *Phyllotoma*, are not of generic value.

Peirson (H. B.). **Observations on the Birch Leaf Mining Sawfly.**— *J. Econ. Ent.*, xxii, no. 3, pp. 588–594, 23 refs. Geneva, N.Y., June 1929.

Further data are given concerning the birch leaf-mining sawfly, *Phyllotoma nemorata*, Fall. (*Phlebatrophia mathesoni*, MacG.) [see preceding paper and *R.A.E.*, A, xvi, 521]. This insect has spread at an alarming rate from Nova Scotia westward across New Brunswick and Maine into New Hampshire. The stages are described, and the method of emergence of the adult and of oviposition are discussed. It is evident from the rate of dissemination that the adults can fly long distances. Temperature seems to be a dominant factor in their activities, cold or cloudy weather keeping them inactive, usually on the lower surface of the leaves. One female deposits approximately 25 eggs, each being placed in a pocket on the margin of a leaf. Seventy per cent. of the eggs were found in leaves of the current year's growth. The average length of the egg stage is 19 days, and for the first week feeding by the larvae is scarcely noticeable, but afterwards shows plainly as brown patches. Seventy per cent. of the feeding is in the outer two-thirds of the leaf away from the petiole; feeding continues until the September frosts, when the larvae form flat circular cells in the leaf, in which the winter is passed. The food-plants recorded are white birch (*Betula papyrifera*), grey birch (*B. populifolia*), yellow birch (*B. lutea*), black birch (*B. lenta*), alder (*Alnus* spp.) and poplar (*Populus* spp.).

A survey of the damage caused to white birch showed that there was great retardation of growth throughout the infested region, amounting in some places, especially in pure type, slow-growing stands, to 80 per cent. The fact that the heaviest injury occurs at a time when the tree is storing up food for the coming season's growth makes the situation particularly serious. Preliminary experiments in control included spraying grey and white birches in late July when the larvae had just begun to mine, with nicotine sulphate 1 : 400, with 1 oz. dissolved laundry soap to each U.S. gallon of spray. The spray took effect very quickly, and the resulting mortality was 98 per cent. on white birch and 100 per cent. on grey birch, untreated trees showing only 2 per cent. mortality. Bordeaux mixture as a repellent diminished oviposition on the sprayed trees, but not enough to be of real value, and brown spots resulted on the surface of the leaf. Only one parasite, an Ichneumonid, *Spilocryptus* sp., has been found. As the pure, slow-growing types of tree are most susceptible to injury, it is suggested that these should be cut first.

Section of Plant Quarantine and Inspection.— *J. Econ. Ent.*, xxii, no. 3, pp. 449–508, 2 figs., refs. Geneva, N.Y., June 1929.

A number of papers are contained in this section. In "The Basis and Aims of Plant Legislation," L. S. McLaine points out that all legislative regulations should be framed with a scientific background and that adequate inspection services should be established in all countries; a

brief review is given of the recently organised Canadian quarantine service. The Regional Board Reports comprise those of the Eastern Plant Board, by T. J. Headlee ; the Southern Plant Board, by R. W. Harned ; the Central Plant Board, by F. N. Wallace ; and the Western Plant Quarantine Board, by W. C. Jacobsen. "Recent Developments in Federal Plant Quarantine Activities," by C. L. Marlatt, describes the quarantine regulations against the importation of certain fruit stocks, the spread of the pink bollworm of cotton [*Platyedra gossypiella*, Saund.], and the remarkable success of the quarantine and eradication measures against the Mexican fruit-fly [*Anastrepha ludens*, Lw.] in Texas (which included a starvation period of seven months during which no fruit attractive to the pest was allowed to develop or remain on the trees).

In "Enforcement of the European Corn Borer [*Pyrausta nubilalis*, Hb.] Quarantine in 1928," L. H. Worthley describes the operation of 179 quarantine posts covering a frontage of approximately 1,450 miles.

In "The Present Status of Gipsy Moth, Brown-tail Moth and Satin Moth Control," by A. F. Burgess, the measures carried out in recent years are briefly reviewed. The western spread of the gipsy moth [*Porthetria dispar*, L.] in western New England and eastern New York has been checked, but since 1924 when the acreage defoliated in the eastern part of the infested territory was the smallest of any time during the last 20 years, there has been a rapid increase in the numbers of the insect and in the areas defoliated. The situation is therefore more threatening than ever before, and if the barrier zone has to be moved westward into the Adirondack and Catskill Mountains, control will be far more difficult and expensive than hitherto. The brown-tail moth [*Nygmia phaeorrhoea*, Don.] is being held in check in most of the infested territory as a result of local field control operations, the work of natural enemies and the periodical effect of adverse weather conditions, especially low winter temperatures. The satin moth [*Stilpnotia salicis*, L.] continues to spread ; the quarantine against it has been extended, and transport of poplar and willow trees from the quarantined area is prohibited.

In "A Brief Summary of Fruit Fly Surveys in Argentina, Spain and the Canary Islands," by M. Kisliuk, jr., *Anastrepha fraterculus*, Wied. (West Indian fruit-fly) is recorded from the northern and north-western provinces of Argentina. *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) was taken in the province of La Rioja and has been found in the past in the province of Buenos Aires. It was still found to be infesting grapes in southern Spain, but was not found in tomatos either in Spain or the Canary Islands. In "Raspberry Mosaic," by J. D. Winter, an account of the disease is given [*R.A.E.*, A, xv, 667]. The Central Plant Board, representing thirteen States, has adopted recommendations for the uniform inspection and certification of raspberry plants, and four States have passed quarantine regulations concerning the entry of these plants. Owing to the general prevalence of these virus diseases, it is suggested that greater uniformity in methods of inspection is more desirable than quarantine action.

In "The Alfalfa Weevil in Alfalfa Meal," by W. H. Larrimer and G. I. Reeves, the results are given of thirteen months' study of the alfalfa weevil [*Hypera variabilis*, Hbst.] in lucerne hay and meal. It was found that the number of weevils present in the crop diminishes with each process in handling the hay, so that the number in a lucerne meal mill at the end of the summer is negligible, and the only source of contamination in the mills is the hay that is being ground. In order to ensure freedom from infestation in the milled product, both grinder and fan in the mill

must operate and the fan must be driven at full speed ; after leaving the fan, the meal moves through tightly closed pipes and chambers to the sacking room, and only a weevil-proof partition is needed between the milling and sacking rooms to prevent contamination of the meal. Cars that have carried infested lucerne hay, however, remain infested for an indefinite time, and as these move rapidly over all parts of the United States, they constitute a real danger. In "The Present Status of the Sweet Potato Weevil in the United States," by R. W. Harned, it is stated that, owing to the success of scouting and eradication measures, it is hoped to effect complete extermination of *Cylas formicarius*, F. (sweet potato weevil) within a few years in Alabama and Mississippi. The situation in the other three seriously infested States, namely, Florida, Louisiana and Texas, is discussed. In the principal sweet potato producing sections of north-east Texas, the roots of the *Ipomoca trifida* and another species of this genus were found to be infested, sometimes as far as 4 or 5 miles from any previous sweet potato crop ; it is impossible to starve out the weevil where these weeds are prevalent.

Section of Apiculture.—*J. Econ. Ent.*, xxii, no. 3, pp. 509–551. Geneva, N.Y., June 1929.

This section includes the following papers : The Respiratory Exchange of the Honey Bee, by G. H. Vansell ; A Study of the Factors influencing the Yield of Honey during the main Nectar Flow, by J. A. Munro ; The Effects of moving Bees at Orchard Blooming Time, by R. Hutson ; and Success in the Artificial Insemination of Queen Bees at the Bee Culture Laboratory, by W. J. Nolan.

Cory (E. N.) & Sanders (P. D.). **Soil Treatment for Control of the Japanese Beetle.**—*J. Econ. Ent.*, xxii, no. 3, pp. 556–561. Geneva, N.Y., June 1929.

Details are given of soil treatment with carbon bisulphide emulsion in Maryland during 1927 and 1928 for the suppression of *Popillia japonica*, Newm. (Japanese beetle), and the apparatus used is described. The methods that have proved successful elsewhere were followed [*R.A.E.*, A, xv, 606, etc.], the insecticide being used at a dilution of 1 gal. stock emulsion to 200 gals. water and applied at the rate of 3 U.S. pints to each sq. ft. of soil surface. Two applications were sufficient, except in very hard or heavy soil, when three were made. Treatments were given only when the soil temperature was above 40° F. and the soil sufficiently dry to take up the solution. Up to the end of 1928, about £4,600 has been spent on these operations in the State, and the indications are that the natural rate of increase of the beetle has been reduced.

Collins (C. W.) & Holbrook (J. E. R.). **Trapping Calosoma Beetles.**—*J. Econ. Ent.*, xxii, no. 3, pp. 562–569, 2 figs. Geneva, N.Y., June 1929.

As an improvement on the usual method of jarring trees in order to dislodge and count the numbers of *Calosoma sycophanta*, L., and similar beetles present, a trap has been devised, which is described in detail and which enables the operator to ascertain the number of beetles to a tree or on a given area. From laboratory experiments, the number of larvae and pupae of *Porthetria dispar*, L. (gipsy moth) destroyed by that

number of beetles and their larvae can be estimated. The trap is made of heavy manilla paper coated with paraffin wax for the purpose of withstanding the weather and also to afford a slippery surface to which the beetles cannot cling in their attempts to climb trees for food. The container is a tin can $3\frac{1}{2}$ ins. in diameter and 4 ins. deep, painted to prevent rust and to obviate the possibility of the beetles climbing up the side. The paper is fixed round the trunk of a tree to form a barrier, and so arranged that the beetles, in trying to pass it, fall into the container. No bait is used in the trap; its value depends on the natural instinct of the adults and larvae of *Calosoma* to climb in search of food. The trap is giving a true index of beetle abundance under various conditions of tree growth, coupled with the rise and fall of gipsy moth infestations. Although *C. sycophanta* has rather low reproductive powers compared with the parasites of *P. dispar*, it will probably disappear more gradually when an outbreak of the host is decreasing. Under laboratory conditions, one pair of *C. sycophanta* and their progeny will destroy, on an average, about 6,000 larvae and pupae of *P. dispar* in a season; as many as 80 per cent. of the host pupae on the trunks and large branches of trees have been found destroyed in this manner. Trapping experiments indicate that there may be as many as 4,216 adults of *C. sycophanta* to the acre in some woodlands, and it might be advantageous to trap the beetles in numbers where infestation by *P. dispar* is at its maximum, in order to transfer them to distant areas where the infestation is still light, but the effect of such changes on the effectiveness of the parasites in the areas concerned would have to be considered.

Bottimer (L. J.). **Notes on Paradichlorobenzene and Naphthalene as Repellents against Clothes Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 3, pp. 570–573. Geneva, N.Y., June 1929.

The following is the author's abstract:—Paradichlorobenzene and naphthalene, used in small quantities in a room of average size, were of no practical value as repellents against larvae of the webbing clothes moth, *Tineola biselliella*, Humm. In tests with each of these insecticides, more than one-half of the larvae concerned remained for two days within six inches of the material and were apparently uninjured.

St. George (R. A.). **Weather, a Factor in Outbreaks of the Hickory Bark Beetle.**—*J. Econ. Ent.*, xxii, no. 3, pp. 573–580, 2 figs., 3 refs. Geneva, N.Y., June 1929.

A study of an outbreak of the hickory bark-beetle, *Scolytus* (*Eccoptogaster*) *quadrispinosus*, Say, during a drought period in North Carolina in 1925, led to the conclusion that a marked deficiency in rainfall weakens hickory trees and renders them attractive to the beetle. The attack of the beetle checks radial growth, causing gradual dying of the foliage and finally the death of the tree, especially in the case of slow-growing mature or over-mature trees of low vitality. Deficiency of rainfall encourages development of the beetles, and excess of rainfall during the period of flight checks their activities and development. Drought alone was not found to kill trees that were not attacked by the beetle.

Shotwell (R. L.). **Some Notes on the Grasshopper Situation in North Central Montana.**—*J. Econ. Ent.*, xxii, no. 3, pp. 581-588, 2 refs. Geneva, N.Y., June 1929.

The grasshopper situation in North Central Montana during recent years is discussed, heavy losses having been sustained by farmers in that region, particularly on account of the lesser migratory locust, *Melanoplus atlantis*, Riley, and, to a smaller degree, *M. bivittatus*, Say (two-striped grasshopper). A study of the conditions during the outbreak of 1926 showed that the eggs of *M. atlantis* were ready to hatch in the spring when warm weather occurred in late April and early May, with the result that hatching became general. There followed a period of cold and unfavourable weather conditions, which apparently killed most of the newly hatched larvae. There is therefore an intimate relationship between physical factors and grasshopper abundance.

Lipp (J. W.). **Notes on the Ovicidal Action of Linseed Oil.**—*J. Econ. Ent.*, xxii, no. 3, p. 594. Geneva, N.Y., June 1929.

During experiments with linseed oil, emulsified with sodium oleate, against the oriental peach moth [*Cydia molesta*, Busck] and the codling moth [*C. pomonella*, L.] in 1927 and 1928, it was observed that susceptibility of the eggs varied with their age, the length of the incubation period and the concentration of the oil in the emulsion. Many of the eggs developed to the "black spot" stage but did not hatch. Raw linseed oil was more effective than boiled, and emulsions of oil alone were more effective than emulsions of oil in which resin had previously been dissolved, but were tested against the eggs of *C. molesta* only.

Chapman (P. J.). **The Striped Peachworm (*Gelechia confusella* Chambers) on Cotoneaster.**—*J. Econ. Ent.*, xxii, no. 3, p. 595. Geneva, N.Y., June 1929.

Gelechia confusella, Chamb. (striped peachworm) is recorded from the ornamental shrub, *Cotoneaster rotundifolia* var. *lanata*, in Virginia, the usual leaves and débris on the lower branches having been webbed together by the larvae as a shelter during feeding. Previous records on peach and sand cherry (*Prunus pumila*) are mentioned [*R.A.E.*, A, vi, 464].

Simmons (P.) & Reed (W. D.). **An Outbreak of the Fig Moth in California.**—*J. Econ. Ent.*, xxii, no. 3, pp. 595–596. Geneva, N.Y., June 1929.

Previous to 1928, infestation of the Californian raisin crop, in which the chief pests were *Plodia interpunctella*, Hb. (Indian meal-moth) and *Silvanus* (*Oryzaephilus*) *surinamensis*, L. (saw-toothed grain beetle), occurred only after prolonged storage. In the 1928 crop, however, raisins were already infested when delivered to packing houses, the pests being *Ephestia cautella*, Wlk. (fig moth) and in much smaller numbers *P. interpunctella*, and fumigation became necessary in late autumn and early winter. The full-grown larvae of both species were extensively attacked by *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.). This early infestation appears to have originated on the plantations,

and an unusually large amount of muscat raisins and discarded figs held over on them from 1927 to 1928 was undoubtedly the cause of the outbreak.

Thomas (W. A.). **Injury to Sweet Potatoes in Storage by the Semi-tropical Armyworm.**—*J. Econ. Ent.*, xxii, no. 3, pp. 596–597. Geneva, N.Y., June 1929.

In November 1928, *Xylomyges* (*Prodenia*) *eridania*, Cram. (semi-tropical armyworm) defoliated sweet potatoes throughout the coastal areas of the Carolinas, being particularly injurious in part of North Carolina. During the harvest, numbers of the larvae were carried in hampers from the fields to the curing houses, and when the temperature of the houses was raised during the curing process, they became very active, feeding on the tubers and tunnelling through them. The larvae apparently crawled from the lower layers to the top of the hampers before feeding to any extent. After curing, when the rooms were cooled to outside temperature, the infestation died down and many of the larvae died without pupating. Decay of the tubers frequently followed the attacks of the larvae.

Bissell (T. L.). **Notes on** *Leptoglossus phyllopus* **L. and** *L. oppositus* **Say.**—*J. Econ. Ent.*, xxii, no. 3, pp. 597–598. Geneva, N.Y., June 1929.

Leptoglossus phyllopus, L. (southern leaf-footed plant bug) was the primary cause of a severe outbreak of kernel spot in pecans in parts of Georgia in 1926. Food-plants recorded for this Coreid are *Yucca flaccida, Cirsium spinosissimum elliotti, Datura tatula*, and cowpeas. These are attacked in regular sequence, in the above order, which is that of their flowering and fruiting. *L. oppositus*, Say, which is much less numerous, has been observed on peach fruit and on cowpeas.

Packard (C. M.). *Ateloglossa cinerea* **Coq., a Parasite of** *Melanotus* **sp.**—*J. Econ. Ent.*, xxii, no. 3, p. 598. Geneva, N.Y., June 1929.

The Dexiid, *Ateloglossa cinerea*, Coq., is recorded as a parasite of an Elaterid, *Melanotus* sp., in Massachusetts, only one fly emerging from each host. The larva emerged through the side of the host and formed a puparium at or just below the level of the ground. In the field, the parasitised larvae seem habitually to come to the surface of the soil about the time the parasites are ready to emerge from them.

Gentner (L. G.). **An unusual Occurrence of** *Thrips nigropilosus* **Uzel on Cultivated Spearmint.**—*J. Econ. Ent.*, xxii, no. 3, pp. 598–599. Geneva, N.Y., June 1929.

Thrips nigropilosus, Uzel, has been found causing an unusual infestation on several varieties of cultivated spearmint in Michigan, the lower leaves showing whitened areas and many falling off. The injury, occurring shortly before distilling, rapidly reduces the yield of oil. As soon as the infestation was noticed, the plants were dusted with sulphur, and a week later all the thrips had disappeared. Other records of this thrips are mostly from greenhouses; it has also been recorded in the field on mullein [*Verbascum*] in New York, and on wild lettuce [*Lactuca*] in Iowa.

Smith (R. H.). **The Lethal Dose of Arsenic for the newly-hatched Codling Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 3, pp. 599–600. Geneva, N.Y., June 1929.

Following his previous discussions on quantities of arsenic on apples in relation to the control of the codling moth [*Cydia pomonella*, L.] [*R.A.E.*, A, xiv, 488; xvi, 675], the author computes the amount of arsenic likely to be ingested by a larva in entering the fruit when the average spray of lead arsenate has been applied, and finds it considerably less than the lethal dose. He considers, however, that any calculations are speculative until more exact data as to the method of absorption of the poison are secured. He has observed cases in which larval excrement was ejected within half an hour of entering the fruit, and he suggests that in some cases the first particles swallowed may pass rather quickly through the digestive tract, only a small fraction of the arsenic being retained in the body.

Lipp (J. W.). **Studies of Substitutes for Arsenate of Lead as a Soil Insecticide.**—*J. Econ. Ent.*, xxii, no. 3, pp. 600–601. Geneva, N.Y., June 1929.

The author has tested a large number of chemicals as soil poisons against larvae of *Popillia japonica*, Newm. (Japanese beetle), using them at the rate of 1,500 lb. to the acre. The larvae were killed by the fluosilicates of sodium and barium, by mercuric borate and iodide and by mercurous chloride. In pots, 0·825 gm. was used to each 4-in. pot. Previous experiments had indicated that nearly all grasses used for fine turf grew normally in soil poisoned with lead arsenate at the rate of 1,500 lb. per acre, the exceptions being rough-stalked, Canada and annual bluegrass [*Poa trivialis*, *P. compressa* and *P. annua*]. Seed of these grasses was therefore planted in pots of soil poisoned at the same rate with sodium fluosilicate, barium fluosilicate and mercurous chloride; in all cases the grasses grew normally and were as vigorous as the grasses grown in unpoisoned soil. Mercuric borate, mercuric iodide and mercurous chloride are considered unpractical owing to their high price. In the field, the ground was first cleared of all grass, roots, stones, etc., and the poison was then applied in the form of a fine powder and worked in the soil to the required depth with a hoe, the surface being then smoothed over with a rake and the seed planted. When sodium fluosilicate was used, plots exposed to sunlight throughout the day tended to harden on the surface, sometimes to such an extent as to prevent germination of the grass seed. When barium fluosilicate was used there was very little hardening of the surface; soil poisoned with this chemical was toxic to the larvae and had no deleterious effect on grasses, including the three mentioned above. The experiment was continued for two years, and during that time larvae placed in the soil were readily killed, but the length of time during which the soil will retain its toxicity is uncertain.

Flanders (S. E.). **A simple Method of obtaining Moth Eggs.**—*J. Econ. Ent.*, xxii, no. 3, p. 601. Geneva, N.Y., June 1929.

A method is described for obtaining the eggs of the Angoumois grain moth, *Sitotroga cerealella*, Ol., in numbers for use as hosts for *Trichogramma* [*minutum*, Riley], where quantities of grain heavily infested by

the moth are stored. Burlap sacks are laid out loosely on maize either in the cob or shelled, and moths congregate in numbers on the lower surface. Once or twice a day each sack is lifted clear of the grain and looped to form a funnel, the lower end encircling a cylindrical receptacle made of 20-mesh brass screen about 8 ins. in diameter. Several sharp blows on the burlap precipitate the moths into the screen container. The container is then placed horizontally and a current of air directed through it, so that the moth eggs drop through the screen into a trough below and the moth scale dust passes off through a vent. The container should be shaken or rotated to dislodge eggs adhering to the moths, and any adhering to dead moths may be rinsed off under water pressure and dried.

Mickel (C. E.). **The Eggplant Leaf-miner, *Phthorimaea glochinella* Zeller, in Tomatoes shipped from Mexico.**—*J. Econ. Ent.*, xxii, no. 3, pp. 602–603. Geneva, N.Y., June 1929.

Larvae of *Phthorimaea glochinella*, Zell., have been intercepted in Minnesota in tomatos from Mexico.

Gahm (O. E.). **Hibernation of the Striped Cucumber Beetle.**—*J. Econ. Ent.*, xxii, no. 3, p. 603. Geneva, N.Y., June 1929.

Very little is known about the hibernation quarters of *Diabrotica vittata*, F. (striped cucumber beetle). In October, in Ohio, 27 beetles were found under leaves in an area of 5 ft. square in woodland and were fairly active upon removal from the leaves; the nearest planting of cucurbits had been about a quarter of a mile distant. In March, in Colorado, beetles were found in several places hibernating under leaves, berry canes and other rubbish. In May, none was observed, and squash plants growing beside some of the berry canes were not infested.

Cotton (R. T.) & Young (H. D.). **The Use of Carbon Dioxide to increase the Insecticidal Efficacy of Fumigants.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 5, pp. 97–102, 1 table, 4 refs. Washington, D.C., May 1929.

Carbon dioxide has frequently been recommended as a fumigant for insects, but when used alone, has never proved very satisfactory [*cf. R.A.E.*, A, viii, 178]. In a series of experiments, the results of which are tabulated, various concentrations of carbon dioxide mixed with other fumigants were tested on *Tribolium confusum*, Duv. (flour beetle). The carbon dioxide was put into 6-litre glass flasks and allowed to stand for a few minutes before the fumigant was added. Ethylene bichloride used alone at the rate of 4 mg. per litre killed only 50 per cent. of the beetles in 5 hours, whereas when the same amount was added to 330 mg. carbon dioxide, all died within 3 hours. Ethylene bichloride alone at 84 mg. per litre destroyed all the beetles in 4 hours, but the same quantity in combination with 330 mg. carbon dioxide produced the same result in an hour. Similarly a dosage of 4 mg. per litre of pure methyl chloroacetate killed all the insects in 5 hours as compared with 1 hour when it was added to 330 mg. carbon dioxide. Carbon bisulphide

at the rate of 250 mg. a litre and chloropicrin at 17 mg. a litre gave 100 per cent. mortality in $2\frac{3}{4}$ and $1\frac{1}{2}$ hours respectively, but with the addition of 330 mg. carbon dioxide the same result was obtained in 90 and 20 minutes. A dosage of carbon dioxide at the rate of between 165 and 330 mg. a litre (10 and 20 lb. per 1,000 cu. ft.) is the best for general fumigation work. Carbon dioxide is at present being used to some extent in commercial vacuum fumigation in combination with carbon bisulphide, which is inflammable, heavy concentrations of it being employed (740 cu. ft. is used with 200 cu. ft. carbon bisulphide) in order to reduce the risk of fire. It has the added advantage that it is not injurious to man and does not affect the products fumigated.

Schenk (G.) & Dean (G. A.). **Hydrocyanic Acid Gas Penetration in 140 Pound Bags of Flour under Atmospheric Conditions.** — *J. Kansas Ent. Soc.*, ii, no. 3, pp. 60–66. McPherson, Kans., July 1929.

In view of the general opinion that hydrocyanic acid gas will not successfully penetrate flour and other milled products to a depth of more than 2 or 3 inches, experiments were carried out to determine the minimum amount of gas necessary, at an exposure allowing one fumigation daily, to overcome adsorption by the outside layers of 140-lb. bags of flour under ordinary conditions of atmospheric vault fumigation. The experiments are described in detail ; pill boxes containing examples of *Tribolium confusum*, Duv. (confused flour beetle) were buried at varying depths in the bags.

The conclusions reached were as follows : Flour in 140-lb. bags can be successfully penetrated by HCN in a metal-lined vault, when the bags are separated to allow the gas to surround each bag, and when sufficient HCN is applied to maintain a lethal concentration after the product fumigated has adsorbed its quota of gas at the prevailing concentration and temperature. Long exposure (20 hours) is more economical than increasing the dosage for a shorter exposure. Since the amount of gas adsorbed is inversely proportional to the temperature, increased temperatures should permit of reduction of dosage or shortening of exposure.

Friend (R. B.). **The Asiatic Beetle in Connecticut.** — *Bull. Connecticut Agric. Expt. Sta.*, no. 304, pp. 585–664, 4 pls., 24 figs., 15 tables, 4 pp. refs. New Haven, Conn., March 1929.

This is a more detailed account of the bionomics of *Anomala orientalis*, Waterh. (Asiatic beetle) in New Haven, Connecticut, than one already noticed [*R.A.E.*, A, xv, 442], with a very complete description of all its stages and notes on its history, distribution and systematic position.

There is at present no effective natural control of this Rutelid in New Haven. In September 1928, however, 290 individuals of *Tiphia popilliavora*, Rohw., a Scoliid parasite of the larvae from Japan, were released. Attempts at insecticidal control of this beetle in the past are discussed and further experiments described, particular reference being made to soil treatment with carbon bisulphide emulsion [xv, 442, 500 ; xvi, 264] and with lead arsenate [xvii, 446]. Carbon bisulphide emulsion is effective only for a short time, and lead arsenate gives more permanent control.

Monteith (J.), jr., & Hollowell (E. A.). **Pathological Symptoms in Legumes caused by the Potato Leaf Hopper.**—*J. Agric. Res.*, xxxviii, no. 12, pp. 649–677, 1 pl., 13 figs., 20 refs. Washington, D.C., 15th June 1929.

Field observations, some of which have been previously noticed [*R.A.E.*, A, xv, 283, 458], have shown that the potato leafhopper, *Empoasca fabae*, Harr., causes serious damage to a number of leguminous crops in the United States, the losses to forage crops being greatest throughout the clover belt and southwards. The particular effect on various food-plants, such as clover, lucerne, sweet clover (*Melilotus*), cowpeas (*Vigna sinensis*), soy-beans, bird's foot trefoil (*Lotus corniculatus*), beans, etc., is discussed, together with the varietal differences in resistance, the characteristic response of each plant to infestation and the effect of weather conditions. Yields of hay or forage may be seriously reduced by leafhoppers and seed production may be restricted. In lucerne, it has been noticed that the characteristic yellowing due to infestation shows marked variation in neighbouring plots cut at different times; various explanations have been offered for this, but it is suggested that the difference may be due to migration of the leafhoppers from plot to plot. The present observations confirm the theory [xvii, 281] that the damage is not purely mechanical, but is the result of some disturbance of the metabolic processes of the plant due to injection of an enzyme or toxin, which apparently remains more or less localised.

Cunningham (H. S.). **Report of Plant Pathologist.**—*Rep. Dept. Agric. Bermuda 1928*, pp. 26–28. Hamilton, 1929.

Septanychus (*Paratetranychus*) *tumidus*, Banks, was abundant on *Cosmos* in one locality during August and September, but was successfully controlled with sulphur dust. *Morganella longispina*, Morg. (black scale) causes considerable injury to figs, and in at least two localities it killed a number of trees of papaya [*Carica papaya*]. It can easily be controlled with lime-sulphur, 1 : 40. A serious infestation of this scale was reported on oleander [*Nerium oleander*], and several outbreaks of *Aulacaspis pentagona*, Targ. (oleander scale) also occurred; its parasite [*Aphelinus diaspidis*, How.] was observed to be active in most cases. The native palmetto (*Sabal blackburnianum*) was found to be badly attacked by *Comstockiella sabalis*, Comst. (palmetto scale) in early November; a consignment of parasitised scales was received from Florida and the parasites liberated. Mealybugs seriously damaged stored potatoes during the summer. Early potatoes were severely injured by the Noctuid, *Xylomyges eridania*, Cram., and a great reduction both in quantity and quality of the watermelon crop was caused by the leafhopper, *Empoasca fabae*, Harr. (*mali*, Le B.) during July; this loss might have been largely avoided by spraying with Bordeaux mixture.

Nolla (J. A. B.). *Acrostalagmus aphidum* **Oud., and Aphid Control.**—*J. Dept. Agric. Porto Rico*, xiii, no. 2, pp. 59–72, 2 pls., 6 refs. Rio Piedras, P.R., June 1929.

An account is given of a study on a fungus attacking Aphids in Porto Rico that was previously recorded as *Acrostalagmus albus* [*R.A.E.*, A,

vi, 105] but is now considered to be *A. aphidum*. It was found that the spores are unable to germinate after five days in the absence of moisture and that Aphid juices, as compared with distilled water, have a stimulating effect on their germination that varies according to the species used. The fungus has been reported as attacking *Aphis gossypii*, Glov., *A. pseudobrassicae*, Davis, *Myzus* (*Rhopalosiphun*) *persicae*, Sulz., *Toxoptera aurantii*, Boy., *Sipha flava*, Forbes, *Carolinaia cyperi*, Ainslie, and other Aphids; it has also been recorded on *Corythaica monacha*, Stål (egg-plant lace-bug).

The fungus did not kill the corn aphis [*Aphis maidis*, Fitch] under natural conditions, and experiments also indicated that it is incapable of parasitising individuals of this species, though it may live in a saprophytic manner on their dead bodies. Numerous greenhouse experiments are described in which Aphids on various food-plants sprayed with a suspension of the spores of the fungus were successfully infected and destroyed, and a field trial of this method of control was subsequently undertaken on *M. persicae* infesting egg-plant (*Solanum melongena*). A suspension of spores prepared from cultures and from the dead bodies of infected Aphids was sprayed during a cool afternoon over the lower surfaces of a few of the leaves on which the Aphids were feeding, the majority of the plants in alternate rows being treated. During the days following the treatment, the weather was cloudy with light intermittent rains, the fungus developed luxuriantly, and at the end of the first week most of the Aphids on the sprayed plants were dead. In fourteen days the infection had extended over the entire field, and in less than three weeks most of the Aphids were infested. The results show that control of Aphids in the field can be effected by this method. Owing to favourable weather conditions, a new outbreak of Aphids occurred about three weeks later, but infection with the fungus took place almost immediately, showing that only one inoculation of the Aphids in a field is necessary and that the fungus lives in a saprophytic manner in the soil. Egg-plants were grown in the same field during 1927 and 1928, and although Aphids re-appeared during rainy periods, a recurrence of the fungus controlled them in both years, indicating that once a field is inoculated, the fungus may persist for a number of years. The author is convinced that this method of control would be equally effective against Aphids on other crops.

Aphid infestations occurring on egg-plant and cucumber grown in pots during 1927 and 1928 were also controlled by the fungus, which appeared to have existed in the soil since the preliminary experiments were carried out in the greenhouse during 1926. No fungicides were used in the greenhouse, but although it seems probable that fungicides used for the control of injurious fungi would also check the action of *A. aphidum*, it is possible that the fungus might survive in the soil (unless this were also treated for the elimination of micro-organisms) and attack the Aphids to a certain degree in the intervals between sprayings.

Uma familia de terriveis percevejos. [A Family of noxious Bugs.]—*Chacaras e Quintaes*, xxxix, no. 4, pp. 397–398, 2 figs. S. Paulo, 15th April 1929.

The Reduviid, *Apiomerus nigrilobus*, Stål, is recorded as preying on honey-bees in Brazil.

Simmonds (H. W.). **The Life History of** *Teleonemia lantanae.*—*Agric. J. Fiji*, ii, no. 1, pp. 36–39, 1 pl. Suva, 1929.

The Tingid, *Teleonemia lantanae*, Dist., which was introduced into Hawaii from Mexico in 1902 to assist in the control of the weed, *Lantana camara*, is being bred in Fiji from material from the former country and is well established in one of the districts near Suva where liberations have recently been made. The species of *Lantana* common in the vicinity of Suva, which was always considered to be *L. camara*, has lately been identified as *L. crocea*.

The adults attack the larger veins on the lower surfaces of young leaves, which become brown and curl inwards. The period between mating and oviposition is probably very short. The total number of eggs deposited by one female is unknown, but several batches are apparently laid at short intervals, each consisting of about 25 eggs separately placed in the veins. In normal summer weather they hatch in about a week, and it seems certain that the life-cycle occupies about 3 weeks. Under favourable circumstances, therefore, the insect should be capable of multiplying very rapidly. It is, however, difficult for the bug to become established in Fiji owing to the presence of natural enemies, and it has been found advisable to liberate it on isolated bushes rather than on plants growing together on a large area. The most important predator is the Lygaeid, *Germalus pacificus*, Kirk., which attacks both eggs and nymphs, though it also feeds on the seeds of *Lantana*.

Harukawa (C.). **Further Notes on the Rush Saw-fly,** *Tomostethus juncivorus* **Rohwer.**—*Ber. Ōhara Inst. landw. Forsch.*, iv, no. 1, pp. 95–101, 6 refs. Kuraschiki, 1929.

In Hyôgo, Japan, the seasonal history of *Tomostethus juncivorus*, Rohwer, a sawfly attacking rushes [*Juncus*], differs from that observed in Okayama [*R.A.E.*, A, xiv, 3], as there are three generations a year, the adults being observed from mid-April to mid-May, mid-June to mid-July, and mid-August to mid-September. The spring emergence from the hibernated pupae takes place about 14 days earlier than in Okayama. There is very little difference between Okayama and Hyôgo in the mean monthly air temperature and humidity, except that from March to June the mean of the daily maximum temperature in Hyôgo is about 1° F. higher and the rainfall from February to June is 10–30 mm. [0·4—1·2 ins.] more. Sawflies transferred from Hyôgo to Okayama retained their habit of earlier emergence in spring and the emergence of a large proportion of the spring brood in June.

Kono (H.). **The Life-histories of** *Byctiscus congener*, **Jekel,** *B. venustus*, **Pascoe, and** *Deporaus uniformis*, **Roel.** [*In Japanese.*]—*J. Sapporo Agric. For. Soc.*, no. 91, pp. 173–188. Sapporo, 1929.

Byctiscus congener, Jekel, and *B. venustus*, Pascoe, occur in May and June, the former rolling the leaves of *Tilia* spp., *Betula ermani*, *Populus tremula*, *Corylus rostrata*, *Ulmus laciniata* and *Prunus* for oviposition, and the latter those of *Acer* spp. *Rhynchites* (*Deporaus*) *uniformis*, Roel., feeds on the leaves of *Quercus glandulifera*.

NOYORI (C.). *Pygaera anastomosis* **L. I.** [*In Japanese.*]—*J. Plant Prot.*, xvi, pp. 392–404. Tokyo, July 1929.

The Notodontid, *Pygaera anastomosis*, L., is widely distributed in Japan, where the larvae feed on the leaves of *Populus* and *Salix*. There appear to be about five generations a year, the second instar larvae hibernating in crevices on the bark. They begin to feed at the beginning of April and pupate at the beginning of May, the adults emerging about 17 days later. All stages occur during the summer. The female lays from 700 to 900 eggs in 6 or 7 days.

TAKAI (S.). **Studies on the Family Zygaenidae. I. The Life-history of** *Pryeria sinica* **Moore.** [*In Japanese.*]—*Res. Bull. Gifu Imp. Coll. Agric.*, no. 3, pp. 1–40, 2 pls. Gifu, September 1928. (With a Summary in English.)

Pryeria sinica, Moore, which has one generation a year, is widely distributed throughout Japan, hibernating in the egg stage. The larvae hatch at the end of March and beginning of April and feed on the leaves of *Euonymus* spp. and *Celastrus articulatus*. They pupate in crevices or under stones on the ground in May and June, the moths appearing at the end of October or in November. They are active on clear days and lay from 70 to 200 eggs in clusters on the tips of the branches. Sprays of derris or pyrethrum may be used for control, but arsenicals are more effective. The collection of the adults, larvae and eggs is also recommended.

KOJIMA (T.). **Immature Stages of some Japanese Cerambycid Beetles, with Notes on their Habits.**—*J. Coll. Agric. Tokyo*, x, no. 2, pp. 101–128, 1 pl., 5 figs., 13 refs. Tokyo, 20th March 1929.

This paper contains descriptions of the eggs, larvae and pupae of 5 Lamiids from Japan, with notes on their biology and distribution.

Batocera lineolata, Chevr., infests many species of oak (but not *Quercus myrsinaefolia*), *Castanea sativa*, *Pasania cuspidata*, *Fagus japonica* and *Ulmus americana*. Figs, loquats (*Eriobotrya japonica*) and *Salix* spp. are also said to be attacked. The female oviposits on trunks and large branches apparently from late June to late July, a scar about 1 cm. long and 1·5 mm. wide marking the position of the egg. The larvae mine beneath the bark and into the wood. The larval stage apparently occupies about 14 months, the pupal about 4 and the adult at least 6. A Chalcid infests the eggs, as many as 102 parasites being once obtained from one, but the rate of parasitism varies considerably. Larval control by chemical and mechanical means is possible owing to the simplicity and limited length of the gallery, which is 5–6½ ins. long, and the eggs are easily detected and crushed.

Apriona rugicollis, Chevr., is a serious pest of mulberry and also attacks other trees, including figs. In captivity one female laid 116 eggs during 79 days. They usually hatch in about 14 days, but when laid in the autumn, remain dormant throughout the winter. The larva makes a long gallery in the stem or even the root of young trees, with openings at intervals along it. One generation occupies two years in Japan, but only one in Formosa, the adult appearing during July and August in the former country and from late May to August in the latter. Control measures recommended are collection of the beetles in the early

morning and mechanical destruction of the eggs and larvae. An aqueous solution of pyrethrum was injected into the galleries with fairly satisfactory results. *Cagosima sanguinolenta*, Thomson, attacks *Alnus japonica* and *Betula alba*. One or more eggs are usually laid between the bark and sapwood of young, weak trees. The larvae bore up the centre of the stem for a distance of about 6 ins. and pupate at the top of the tunnel.

The larva of *Thyestilla gebleri*, Fald., mines in the stem of hemp, *Cannabis sativa*, nearly to the end of the root. It pupates in a piece cut off the end of the root, the open end of which is plugged with fibrous shreds. The life-cycle occupies a year, the winter being passed in the larval stage. The adults emerge in May and July. *Aulaconotus pachypezoides*, Thomson, attacks *Glibertia trifida*. Oviposition results in a considerable flow of resin down the bark. Twigs 10–20 mm. in diameter are completely hollowed out by the larvae for a short distance near the end, and pupation occurs in them about the end of July. Some adults were bred out in August and September. Several half-grown larvae and 3 adults were collected on a twig in early January, but it is doubtful whether overwintered beetles oviposit the following spring. The infested twigs, the broken ends of which hang down, should be removed.

KABURAKI (T.) & KAMITO (A.). **Attraction of the Rice Borer Moth to Lights at different Periods.**—*J. Coll. Agric. Tokyo*, x, no. 2, pp. 151–158, 1 fig. Tokyo, 20th March 1929.

Chilo simplex, Butl., is very destructive to rice and widely distributed from Hokkaido to Formosa. There is only one generation a year in the north, 3 or 4 in Formosa and other warm regions and two in most parts of Japan, the larvae hibernating in dead haulms or straws. Light traps have proved one of the most efficient means of controlling the moths and are more efficacious before midnight than after, females then being in the majority; after midnight, the males are the more prevalent. A high rate of attraction to light is shown by the females an hour or two after sunset and by the males one or two hours later. This attraction reaches a high rate in females at about the time mating and egg-laying begin, and in males at about the time that mating is accomplished.

KAWADA (A.). **The Eggs, Larvae and Pupae of** *Dasychira strigata*, **Moore, and** *D. lunulata*, **Butl.** [*In Japanese.*]—*Kontyû*, iii, no. 2, pp. 85–88, 1 pl., 3 figs. Tokyo, July 1929.

Dasychira strigata, Moore, and *D. lunulata*, Butl., have at least two generations a year in Japan, and the larvae feed on oak. *D. lunulata* also attacks chestnut; it hibernates in the pupal stage, the adults appearing in April and May and again in August.

TAKAHASHI (S.). **On an Outbreak of** *Bruchus rufimanus*, **Boh., an imported Pest.** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 7, pp. 219–222. Gifu, July 1929.

An outbreak of *Bruchus rufimanus*, Boh., which was imported into Japan some years ago, is recorded on beans in Kyushu.

NAWA (Y.). **On the Outbreak of *Caligula japonica* Moore, and its Food-plants.** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 7, pp. 222–227, 2 figs. Gifu, July 1929.

The saturniid *Caligula japonica* Moore is widely distributed throughout Japan where it has one generation a year, hibernating in the egg stage. The larvae feed on the leaves of numerous trees, including various fruit trees. They occurred in enormous numbers in 1929, defoliating chestnut trees near Gifu. Outbreaks of this moth appear to take place at intervals of 12 or 13 years.

MIYAKI (K.). **The Pathology of Silkworms. I.** *In Japanese.* — 361 pp. Meibundo, Tokyo, November 1928.

This volume deals with the animal enemies of the silkworm [*Bombyx mori* L.] in Japan. These include the mite, *Pediculoides ventricosus*, Newp., which is very common and which was first recorded as a pest in 1917, and the Tachinid parasites, *Sturmia sericariae*, Rond., and *Tricholyga bombycis* Beck. The silkworms are also killed by contact with the poisonous hairs of the larvae of *Arctornis chrysorrhoea*, L. [*Porthesia similis*, Fuess.], which feed on mulberry. This moth has three generations a year, hibernating in the larval stage.

TAKAHASHI (R.). **Observations on the Coccidae of Formosa. Part I.** —*Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 40, 82+3 pp., 12 figs. Taihoku, May 1929.

Notes are given on 113 species and two varieties of Coccids found in Formosa, including 7 new species, with a list of some 225 species of plants, showing the Coccids that feed on each. The economic importance of various species is discussed, and an account is given of the association of numerous Coccids with the ant, *Cremastogaster rogenhoferi*, Mayr, which is very abundant throughout the lowlands of Formosa.

FRANSSEN (C. J. H.). **De teelt op Java van eenige gewassen behoorende tot het geslacht *Allium*.** [The Cultivation in Java of some Plants of the Genus *Allium*.]—*Landbouw*, iv, no. 9, pp. 567–602. Buitenzorg, March 1929. (With a Summary in German.)

Thrips tabaci, Lind., is the chief pest of shallots in Java, being especially harmful late in the east monsoon [the dry season, April-September]; at low altitudes a total loss of crop may result. Several other species of Thysanoptera were also observed, but no injury by them has been recorded. *Euchrysma* (*Caradrina*) *exigua*, Hb., is a serious pest in some districts. *Prodenia litura*, F., seldom does important injury, but larvae of the genus *Agrotis* occasionally prove harmful in the hills. *Utetheisa* (*Deiopeia*) *pulchella*, L., is of very minor importance. Fumigation with carbon bisulphide proved successful against *Trichobium* and other pests in seed shallots, and also promoted sprouting, an effect of this fumigant previously noted by van der Goot in the case of seed potatoes.

Thrips tabaci also attacks chives, leeks, *Allium fistulosum* and garlic, though the injury caused to the last-named is negligible. Other pests of *A. fistulosum* are *P. litura*, *L. exigua* and *Amsacta lactinea*, Cram.

Paul (W. R. C.). **The Control of Black Beetle** (*Oryctes rhinoceros* **L.**) **in Coconut Palms.**—*Trop. Agriculturist,* lxxii, no. 5, pp. 272–275. Peradeniya, May 1929.

The adults of *Oryctes rhinoceros*, L., commonly attack the crowns of healthy coconut palms of all ages in Ceylon, boring through the leaf sheaths and immature leaves and stalks around the central bud, but seldom cause serious injury. In young palms, however, growth may be considerably retarded. In severe attacks much of the crown is destroyed and, in rainy weather, a decay of the bud tissues sets in, which eventually leads to the death of the palm. *Rhynchophorus ferrugineus*, F. (red weevil), which mainly infests the stem of young palms [*R.A.E.*, A, xvi, 446], may be attracted to the crown by this decay, but rarely by the normal damage done by *Oryctes*. *O. rhinoceros* feeds on the sap issuing from the wounded tissues, and infestation may be detected by the protrusion of pieces of fibre from the bases of the younger leaves. The damage, which consists of characteristic notches and serrations on the leaflets and irregular holes and scars on the leaf bases, is seen when the leaves unfold.

The method of collecting adults from the trees is laborious and expensive. Elimination of breeding-places by the burial of accumulated leaves and succulent stems to a depth of several inches is recommended, as, on decomposition, they provide valuable manure; this is not advisable on heavy undrained land, where toxic compounds may be liberated from the vegetable matter. With woody material, however, burning is preferable, the ash being used as a source of potash for the plant. The general prevalence of this beetle in Ceylon may partly be ascribed to neglect in the disposal of decaying palm stems. Except in dry districts, the burning of these is difficult, but splitting them from the apex down to the harder tissues to allow the segments to dry provides enough protection, since breeding commences in the less mature tissues ; the harder wood is split when sufficiently decayed. In young palms that have died, the whole stem must be split. Should the cost of splitting prove prohibitive on a large scale, deep burial of all dead parts should be carried out, lime being added to hasten decomposition. The leaf bases, which may attract ovipositing females, decay slowly, and, being useless as manure, should be cut off and burnt. Mounds of grass 3 or 4 ft. high with a slight central depression to facilitate the collection and entry of rain water, or coconut logs split into two and piled up, are very successful traps. All stages of the beetle, the eggs of which are laid in specially constructed cocoons, should be collected from them every 10 or 14 days.

Jepson (F. P.). **Report on a Visit to America in Connection with the Control of** *Calotermes* **in living Plants.**—*Trop. Agriculturist,* lxxii, no. 5, pp. 307–311. Peradeniya, May 1929.

As a result of discussion with Dr. T. E. Snyder regarding the increasing injury to living economic plants by termites in Ceylon, particularly to tea by *Calotermes militaris*, Desn., and *C. dilatatus*, Bugnion & Popoff, certain suggestions for dealing with the problem are given.

Complete eradication of an invading colony must be aimed at, since a few survivors are capable of refounding it in the course of time. The introduction of a small quantity of Paris green powder into the galleries of certain termites on fruit trees has been found most effective in

Hawaii. It is said that as soon as the poison is consumed, the termites die and their bodies are promptly eaten by their fellows, which are also poisoned, one fatal dose thus persisting until the entire colony has been destroyed. Tea bushes infested by *C. militaris* lend themselves more readily to this treatment than those attacked by *C. dilatatus*, infestation being more centralised and the cavities larger. A close watch should be maintained for injury to living economic plants by species of *Coptotermes*, which is similar to that caused by *Calotermes*. *Coptotermes ceylonicus*, Holmgr., has been found to attack tea in Ceylon, and serious damage to rubber has been caused by a species of this genus in Malaya.

Successful control of termites also depends upon the protection of plants from invasion. With *Calotermes dilatatus*, entrance to tea bushes and seed-bearers and coffee and cacao plants is gained by winged forms of the colonising flight through dead snags and wounds only; the point of entry of *C. militaris* into tea plants is as yet unknown. The possible methods of treating large wounds and cavities are discussed.

THAKAR (B. J.) & DESAI (M. H.). **Woolly-Mites** (*Eriophyes gossypii*) **on Cotton. Its Status and Economic Importance in Gujarat.**— *Agric. J. India*, xxiv, pt. 3, pp. 175–182, 2 pls., 4 refs. Calcutta, May 1929.

Eriophyes gossypii, Banks, has become a serious pest of cotton in certain localities in Gujarat, Bombay, and during 1927–28 heavy infestations were reported from one district. It begins to appear in August, when the plants are about two months old, and increases in numbers as the season advances, infestation reaching its height during November and December, when the leaves of the plants in the affected areas appear ashy white. Experiments showed that the yield of seed cotton from a heavily infested plant may be over 30 per cent. below normal, but the quality of the lint, the weight of seed cotton per boll and the ginning percentage of lint were not affected. The infestation begins on the leaves, and as the flower-buds, flowers and bolls appear, they also are attacked. Examination of 25 plants at weekly intervals during 1927–28 showed that a certain number of flower-buds are affected throughout the season, the maximum number of damaged buds occurring in the first week of January, at which time leaf growth has practically ceased and the buds form the most attractive food for the mites. Affected buds do not produce normal flowers, and the period of opening is generally delayed about three weeks. Young bolls sometimes show signs of attack, but full-grown bolls are invariably free from infestation. No mites were observed in seeds of ginned cotton from affected bolls, and it therefore appears that they are not carried with the seed.

E. gossypii has been found on cotton only, no alternative food-plants having so far been recorded. The presence of infested leaves on cotton stalks of the previous year was noticed up to the end of July 1928, a fact that indicates the possibility of the pest being carried over from one season to the next on the cotton plant itself, and this suggests that there may be no period of hibernation.

Various control measures that have been tried, including irrigation, removal of affected parts of the plants, and spraying with flour paste, are discussed in detail, but none was found to be effective. The

application of sulphur (spray or dust), which is usually successful against mites, caused shedding of leaves, buds and young bolls. Sulphur in the form of sodium polysulphide did not injure the plant but was also ineffective against the mites, possibly owing to the fact that they live under the protection of adventitious epidermal hairs, the growth of which is doubtless caused by the irritation they set up.

ZOLOTAREVSKI (B. N.). **Sur le comportement de** *Locusta migratoria* **L. subsp.** *migratorioides* **Rch. et Frm. phasis** *transiens*.—*C.R. Acad. Sci. Fr.*, clxxxix, no. 3, pp. 131–133. Paris, 1929.

The presence, in the swarms of larvae of migratory locusts, of individuals approaching the respective solitary phase has been observed by various authors in the case of *Locusta migratoria*, L., *Locustana pardalina*, Wlk., and *Schistocerca gregaria*, Forsk. The transformation of larvae of the gregarious phase into the solitary phase in the course of an individual life has been observed under experimental conditions, but as the intermediary forms have not been studied in nature, the moment of their transformation has not yet been determined.

The author's observations were made on *Locusta migratoria* subsp. *migratorioides*, Rch. & Frm., in Madagascar, where certain swarms of the gregarious phase included larvae of the intermediate form.

The number of intermediate larvae in a swarm may be very variable ; the author found about 8 per cent. of them in swarms covering several hectares, while those that contained about 16 per cent. usually covered a few thousand square metres. All the larvae in such swarms, whatever their structure and colour, behaved in the gregarious manner, advancing in the same direction and at the same distance from each other. This was also true of swarms containing up to 43 per cent. of intermediate individuals, although the movements of such swarms were slower.

At the time of transformation into adults, the behaviour of the intermediate form begins to differ from that of the gregarious form. The adult locusts at first follow the swarms of larvae, but the young adults of the gregarious form fly up when disturbed, always returning to the spot occupied by the larvae, while the intermediate individuals under similar conditions take to flight, and after describing a characteristic trajectory, alight anywhere. This difference in behaviour becomes even more marked after the transformation into adults of the bulk of the swarm. The gregarious individuals take to flight in the same direction, remaining in the air for a considerable time ; those approaching the solitary form usually remain on the ground and make only short individual flights. The intermediate forms remain grouped for some time under the influence of habit, but eventually they disperse. The proportion of forms approaching the solitary ones that follow a swarm of locusts is very small, consisting of individuals differing only slightly from the gregarious ones and never coloured green.

It follows from the above that the change of the gregarious habit into the solitary one in the case of *L. migratoria migratorioides* is limited to the few days during which the larvae transform into adults.

The author adopts the nomenclature proposed by him in collaboration with B. P. Uvarov in an article in the press, in which *Locusta migratorioides* is treated as a subspecies of *L. migratoria*, and the following

denominations are allotted to the different phases of locusts: phasis *solitaria* to the solitary phase; phasis *gregaria* to the gregarious phase; and phasis *transiens* to all the intermediary forms between the first two.

GOURDON (G.). **La destruction des insectes par les rayons ultra-violets.**—*Rev. Agriculteurs Fr.*, 1929, no. 6 bis, pp. 52–54, 1 fig. Paris, June 1929.

An apparatus for trapping insects in vineyards is described that is constructed on similar lines to one already noticed [*R.A.E.*, A, xvii, 332], but differs in minor details. The author considers that the insects are attracted to the trap by the ozone formed in the air by the action of the ultra-violet rays from the lamp and are subsequently benumbed by it.

CHAPPAZ (G.). **La lutte contre la cochylis et l'eudémis en 1928.**—*Rev. Agriculteurs Fr.*, 1929, no. 6 bis, pp. 55–59. Paris, June 1929.

An account is given of a campaign against *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., in Champagne during 1928, with reports on the measures carried out in various other parts of France. Lead arsenate, used as recommended in the first three sprays against mildew, proved effective against the first generation, and it is pointed out that if this practice is carried out regularly every year, measures against the second generation will only be necessary when infestation is particularly severe. Owing to the modification of the law permitting the use of arsenicals up to the time of ripening of the grapes, the substitution of lead arsenate for nicotine against the second generation is recommended, since not only is it as effective and less expensive, but it has been found that nicotine is more likely to affect the quality of the wine.

Regular treatment against the first generation is particularly recommended in the case of grapes for table use, since insecticides cannot be used once the fruit is formed.

STEER (W.). **Note on *Anthocoris nemorum* L. (Hemiptera-Anthocoridae).**—*Ent. Mo. Mag.*, lxv, pp. 103–104. London, May 1929.

During a study of the fauna of *Rubus* spp., *Anthocoris nemorum*, L., was observed in numbers attacking the Aphid, *Amphorophora rubi*, Kalt., various Jassids, and the mites, *Tetranychus telarius*, L., and *Paratetranchus pilosus*, C. & F. (*Oligonychus ulmi*, auct.). This bug is also abundant on all kinds of fruit trees and bushes where small Homoptera and *P. pilosus* occur, and on hops, where hop-feeding Aphids and *T. telarius* appear to form its chief diet. There are apparently several generations during the year, all stages being found together throughout the summer. Hibernation occurs in the adult stage, chiefly under moss and loose bark, in crevices and in rubbish on the ground. The bugs readily attack each other. The effect of tar distillate washes on Anthocorids and on *P. pilosus* is briefly discussed [*R.A.E.*, A, xvii, 501].

Davies (W. M.). **The Effect of Variation in Relative Humidity on Certain Species of Collembola.**—*Brit. J. Exptl. Biol.*, vi, no. 1, pp. 79–86, 3 refs. Cambridge, September 1928.

The following is largely taken from the author's summary: Opinions have differed regarding the optimum degree of moisture associated with the presence of Collembola, and experiments were therefore carried out to ascertain the influence of variation in relative humidity on the death rate of certain species.

At a uniform temperature of 25° C. [77° F.] it was found that saturated conditions of environment are necessary for the survival of all the species tested. With the exception of the genus *Entomobrya*, Collembola devoid of a tracheal system proved very susceptible to dry conditions. *Smynthurus viridis*, L., which possesses a tracheal system and a well-developed ventral tube, is much less susceptible to atmospheric dryness, surviving much longer in the unsaturated atmospheres than the other species. An experiment with *S. viridis* suggests that the ventral tube is used for conveying droplets of water from the hairs of the body to the mouth and also serves as a "cleaning" organ. The susceptibility of Collembola to atmospheric moisture was found to have a direct practical application, for although trapping on a tarred surface [*cf. R.A.E.*, A, xiv, 620, etc.] afforded efficient control, it was found essential to apply the method in the early morning or after rain had fallen when they were present in large numbers, for when the surface became dry they moved down into the soil.

Aulló Costilla (M.). **Estudio de una plaga de** *Lymantria dispar* **L., en los encinares del Valle de los Pedroches (Cordoba).** [A Study of an Outbreak of *Porthetria dispar* in the Oak Forests of the Valle de los Pedroches in Cordoba.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 3–5, 9 pls. Madrid [1929].

In describing the campaign against *Porthetria* (*Lymantria*) *dispar*, L., infesting oaks at Villanueva de Cordoba [*R.A.E.*, A, xi, 577; xii, 145; xiv, 372], maps are given showing the extension and decrease of the infested areas. Biological control has proved effective, supplemented by artificial measures where necessary to place the parasites rapidly in a position of numerical superiority.

Mercet (R. G.). **Los "*Aphelinus*" de España.** [Spanish Species of *Aphelinus*.]—*Rev. Fitopat.*, iv–vi (1926-28), pp. 10–18. Madrid [1929].

This paper deals with the Spanish species of the genus *Aphelinus* that parasitise Aphids, a description of the genus and a key to the species being included.

Mercet (R. G.). **Calcidoideos parásitos de Curculiónidos y Escolítidos. 2a Nota.** [Chalcidoidea parasitic on Curculionids and Scolytids. 2nd Note.]—*Rev. Fitopat.*, iv–vi (1926-28), pp. 19–22. Madrid [1929].

In this continuation of an earlier paper [*R.A.E.*, A, xiv, 373], *Cheiropachis colon*, L., is recorded from Spain from *Scolytus* (*Eccopto-*

gaster) *multistriatus*, Marsh., on *Ulmus campestris*, and *S.* (*E.*) *mali*, Bech., on apple, and *Pachyceras xylophagorum*, Ratz., from *Ips* (*Pityogenes*) *quadridens*, Htg., on *Pinus sylvestris*.

Díaz (B.). *Lithocolletis quercifoliella* **Z., y parásitos de esta especie obtenidos en el Laboratorio de la Fauna Forestal Española.** [*L. quercifoliella* and Parasites of this Species obtained in the Laboratory of the Spanish Forest Fauna.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 23–27, 2 figs. Madrid [1929].

Although *Lithocolletis quercifoliella*, Zell., is not an important pest, it is fairly common on the foliage of oaks in some parts of Spain. The adult emerges in spring, the larvae having pupated at the end of the winter. The larval stage therefore occupies most of the cycle of the single annual generation. The parasites obtained were *Apanteles bicolor*, Nees, which has not previously been recorded from this host, and the Chalcids, *Closterocerus* sp., *Chrysocharis* sp., and *Sympiesis sericeicornis*, Nees, which is probably a hyperparasite. *A. bicolor* always emerged about a fortnight later than the adult of its host and has probably only one generation a year on it.

Marina (G.). **Noticia sobre una plaga de hormigas blancas en la provincia de Zamora.** [A Note on an Outbreak of Termites in the Province of Zamora.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 28–29, 64–65, 1 pl. Madrid [1929].

Buildings in a village being threatened by a severe infestation of *Reticulitermes* (*Leucotermes*) *lucifugus*, Rossi, which appeared in 1924, the removal of wood therefrom is prohibited except by authority, and all timber for constructional purposes must be treated with a suitable preservative, while fumigation must be employed against the nests.

Osorio-Rebellón (A.). **La plaga de** *Pissodes validirostris* **Gyll., en montes de pino piñonero de la provincias de Segovia y Valladolid.** [The Outbreak of *P. validirostris* in the Stone Pine Forests of the Provinces of Segovia and Valladolid.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 30–32. Madrid [1929].

The weevil, *Pissodes validirostris*, Gyll., infests the cones of stone pine [*Pinus pinea*] in Segovia and Valladolid. The fertilised female bores into various parts of the cone, even the peduncle, and finally makes holes in which the eggs are placed. The larvae hatch in June, the pupae are found in August, and the adults appear in September and hibernate, ovipositing in the following May and June. The larvae mine the cones and can do serious injury, though not so severe as that caused by *Dioryctria mendacella*, Stgr. The cones of *Pinus pinaster* and *P. sylvestris* are also attacked, but not severely. As this weevil is associated with the more harmful *D. mendacella*, both can be combated together. Third year cones, which are those attacked, should be collected at the end of June and early in July, *i.e.*, before the usual date, and burnt. In winter many adults of *P. validirostris* can be captured by scraping them off the bark up to a height of 6 ft. on to sheets spread around the foot of the tree.

Mola (A.). **Estudios y observaciones que se hacen actualmente sobre algunas plagas que atacan a montes poblados con especies resinosas, en la 2a. Estación Regional de Fitopatologia Forestal (Valencia).** [Studies and Observations now being made on some Pests attacking Forests of Conifers in Valencia.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 33–37. Madrid [1929].

The pests observed included *Lymantria monacha*, L., with the Buprestid, *Phaenops cyanea*, F., as a secondary pest in many cases, *Rhyacionia* (*Evetria*) *buoliana*, Schiff., and *Myelophilus* (*Hylesinus*) *piniperda*, L.

Bezares (E.). **Los escolítidos del pinsapo en la serranía de Ronda.** [The Scolytids of the Pinsapo Fir in the Mountains of Ronda.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 38–42. Madrid [1929].

Cryphalus piceae, Ratz., and *Crypturgus numidicus*, Ferr., have been observed in small numbers in *Abies pinsapo* in the mountains of Ronda, Spain.

Real decreto de reorganización del Servicio de Estudio y de Extinción de Plagas Forestales. [Royal Decree for the Reorganisation of the Service for the Study and Control of Forest Pests.]—*Rev. Fitopat.*, iv–vi (1926–28), pp. 65–75, 2 pls. Madrid [1929].

This decree, dated 7th January 1927, and the orders and regulations pertaining to it, reorganise the Forest Pest Service in Spain in accordance with the aims of the newly founded Instituto Nacional Agronómico de Investigacíon y de Experiencias. The various permanent entomological and pathological forestry stations are allowed to establish mobile units where needed.

Rozsypal (J.). *Lygus pratensis*, **L., ein Schädling der Chrysanthemum und Verbascumkulturen.** [*L. pratensis*, a Pest of Chrysanthemum and *Verbascum*.]—*Zbl. Bakt.* (2), lxxviii, no. 1–7, pp. 143–149, 5 figs., 42 refs. Jena, 27th May 1929.

Lygus pratensis, L., occurred as a pest of chrysanthemum at Brünn, Moravia, in 1927, in which year it also caused serious injury to *Verbascum*, grown as a medicinal plant in another part of the country. An account of its food-plants and control, taken from the literature, is given.

Reckendorfer (P.) & Beran (F.). **Der Arsengehalt von Schweinfurtergrün-Kalkbrühen.** [The Arsenic Content of Sprays of Paris Green and Lime.]—*Wein u. Rebe*, x, no. 12, reprint 5 pp. [? Mainz, 1928.]

An account is given of experiments carried out to ascertain the amount of slaked lime that should be added to a spray of Paris green (3 lb. to 100 gals. water) in order to minimise foliage injury. It was found that increasing amounts of lime up to five times the amount of

Paris green cause the amount of soluble arsenic to decrease progressively. Any further increase of lime does not bring about any further decrease of soluble arsenic and may have a bad effect on the physical composition of the solution and injure the plants.

Hengl (F.), Reckendorfer (P.) & Beran (F.). **Untersuchungen über den Arsengehalt von Trauben und Most als Folge der Schädlingsbekämpfung.** [Investigations on the Amount of Arsenic on Grapes and in Must as a Result of the Use of Insecticides.]—*Wein u. Rebe,* xi, no. 1, reprint 5 pp. [? Mainz, 1929.]

After mention of various papers dealing with the amounts of arsenic traceable on grapes and in must as a result of the use of insecticides, an account is given of original investigations made in Vienna on this subject. The Austrian regulation forbidding treatment with arsenicals after 10th August in each year and the removal of grapes for wine making until 5 weeks have elapsed since the last treatment is shown to be justified.

Zillig (H.) & Niemeyer (L.). **Massenauftreten der Schmierlaus, *Phenacoccus hystrix* (Bär.) Ldgr., im Weinbaugebiet der Mosel, Saar und Ruwer.** [An Outbreak of the Mealybug, *P. hystrix,* in the Vine Region of the Mosel, Saar and Ruwer.]—*Arb. biol. Reichsanst.,* xvii, no. 1, pp. 67–102, 3 figs., 3 pls., 28 refs. Berlin, April 1929.

The mealybug, *Phenacoccus hystrix,* Baer., previously recorded from *Aesculus hippocastanum* and other trees, has occurred in serious abundance since the autumn of 1926 on grape-vines in the regions of the Mosel, Saar and Ruwer. It has been recorded previously on vines in Germany, but only in unimportant numbers. Notes are given on the morphology of both sexes, that of the male being hitherto little known. Reproduction may be oviparous or viviparous, but if eggs are laid, they hatch almost at once. In September or October the larvae seek winter-quarters in cracks in the vine-stakes or under the old bark. In May they infest the young vine-shoots and become mature. From the end of May onwards, they return to their winter-quarters in order to reproduce. The newly hatched larvae wander to the green parts of the vine, usually occurring on the lower surface of the leaves.

This Coccid may be spread by active migration or by wind. All varieties of vines may be attacked, though they differ in the degree of infestation; *Ampelopsis quinquefolia* is sometimes an alternative food-plant. Natural enemies observed included the Encyrtid, *Ericydnus ventralis,* Dalm., and a Coccinellid, *Scymnus quadrimaculatus,* Hbst., but neither is of economic value.

As a result of experiments with a great variety of insecticides, a 10 per cent. carbolineum is recommended for winter treatment. The vine-stakes should be jarred to dislodge as many Coccids as possible, and then the stakes and vine-stocks and the ground beneath should be sprayed. For summer treatment, 1 per cent. tobacco extract (8–10 per cent. nicotine) and 0·1 per cent. nicotine solution (95–98 per cent.) were found satisfactory. The use of wire supports instead of wooden stakes is being tested, as they do not afford shelter to the Coccids.

VAN EMDEN (F.). **Ueber die Zwiebelfliege.** [The Onion Fly.]—*Der Obst- u. Gemüsebau*, 1927, no. 4, reprint 2 pp., 3 figs. Berlin, 1927.

The onion fly, *Hylemyia* [*antiqua*, Mg.], is a serious pest in the district of Calbe, Saxony [*R.A.E.*, A, xvii, 460]. The crop losses of 40–90 per cent. are disproportionate to the small number of flies and are due to the fact that one larva can destroy several seedlings and even in June can by itself destroy a plant. Furthermore, a field of onions that has been too severely thinned yields a crop that does not keep well and is therefore unsaleable. The removal of infested plants with the soil around them is the only measure available against the larvae. Cultivation will expose the pupae to poultry, etc. As regards the use of poison baits against the adults, the flies do not seem to be attracted by odour as much as by sight, and it is suggested that placing the bait on objects attractive by reason of colour or shape is more likely to be effective than the adoption of attractants chosen for their odour.

ESCHERICH (K.). **Die Flugzeugbestäubung gegen Forstschädlinge.** [Dusting from Aeroplanes against Forest Pests.]—*Flugschr. deuts. Ges. angew. Ent.*, no. 12, 60 pp., 22 figs., 42 refs. Berlin, 1929.

This is a more detailed review of the work carried on in Germany since 1925 in the control of forest pests by means of dusting from aeroplanes than one already noticed [*R.A.E.*, A, xvii, 10]. This method has been most successfully employed against the nun moth [*Lymantria monacha*, L.], the pine sawfly [*Diprion pini*, L.] and the oak tortrix [*Tortrix viridana*, L.]. The results secured against the pine moth [*Bupalus piniarius*, L.] have been less satisfactory.

Dusting from aeroplanes is recommended only when the injury is severe and the area affected large. The necessary preliminaries for dusting are discussed, and a specimen of the contract form employed is reproduced. A list is given of various proprietary forms of calcium arsenate used, and the qualities necessary for a satisfactory dust are outlined. Details are given concerning apparatus used to determine the degree of adhesiveness and the resistance to wind and moisture of the dusts. The effect of the poison on the animal population of the forests treated is discussed, with particulars of the police regulations for protection from damage. Instructions are given for observing and checking the results, with notes on the possible causes of failure. Great importance is attached to the technique employed in distributing the dust and the weather conditions prevailing at the time of application.

KIENITZ (—). **Ein neuartiger Verstäubungsapparat für die Schädlingsbekämpfung mittels Flugzeugs. (Vorläufige Mitteilung.)** [A new Dusting Apparatus for combating Pests from an Aeroplane.]—*NachrBl. deuts. PflSchDienst*, ix, no. 6, pp. 47–48, 1 fig. Berlin, June 1929.

A very fine, uniform distribution of a dust insecticide from an aeroplane is achieved by forming the bottom of the container by a series of six parallel, diagonally fluted rollers set slightly apart so as to leave gaps a few millimetres wide. Under the rollers there are six slats that can be opened and closed by means of a lever to regulate the

amount of dust released. The dust in the container rests on the rollers, only a little falling through on to the slats ; the latter do not therefore bear any appreciable weight. The rollers are revolved by worms on a shaft geared to the motor. The dust is thus thrown on the slats and is distributed by them.

VON OETTINGEN (H.). **Schädlingsfragen beim Anbau von Rotklee.** [Pests in the Cultivation of Red Clover.]—*NachrBl. deuts. PflSchDienst,* ix, no. 6, pp. 48–49. Berlin, June 1929.

The Tipulid, *Pachyrrhina maculata,* Mg., is responsible for much injury to red clover in North Germany ascribed to other causes. The larvae occur in the uppermost layers of the soil, or even on the surface. They are active from September onwards, boring into the central shoots or roots and causing the plants to wither. They then leave the plants, and the latter are attacked by fungi, etc., that mask the cause of the injury.

STELLWAAG (F.). **Neuere Erfahrungen in der biologischen Bekämpfung schädlicher Insekten.** [Recent Experiments in the biological Control of injurious Insects.]—*Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928,* pp. 15–32, 26 refs. Berlin, 1929.

This review of recent work in the biological control of injurious insects is mainly based on experiments personally observed by the author in Germany, Italy, France, Switzerland and the United States, together with reports received by him on work carried out in Hawaii, most of which have already been noticed. Among experiments with endemic species, an account is given of an attempt to control *Clysia ambiguella,* Hb., and *Polychrosis botrana,* Schiff., by means of the egg parasite, *Trichogramma evanescens,* Westw., in German vineyards. Although the parasite was observed to emerge normally, no noteworthy reduction was secured in the second generation of moths. This failure is attributed to delayed oviposition of the hosts owing to unfavourable weather in May when the parasites were released, so that the number of eggs available to them was inadequate. *T. evanescens* has been observed to be an effective parasite of *Pieris brassicae,* L., *P. napi,* L., and *Barathra brassicae,* L. [*R.A.E.,* A, xiii, 586].

The introduction and acclimatisation of imported parasites is discussed, and reference is made to the results of such work in various parts of the world.

KOVAČEVIĆ (Ž.). **Ueber die wichtigsten Schädlinge der Kulturpflanzen in Slawonien und Baćka.** [The more important Pests of cultivated Plants in Slavonia and Bacher.]—*Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928,* pp. 33–41. Berlin, 1929.

A brief account is given of the progress of applied entomology in Jugoslavia [*R.A.E.,* A, xv, 112]. The more important pests observed in the provinces of Slavonia and Bacher during the year 1926–27 included : *Oscinella* (*Oscinis*) *frit,* L., *Chlorops taeniopus,* Mg., and *Mayetiola destructor,* Say, on wheat ; *Pyrausta nubilalis,* Hb., which reduced the maize crop by 25–50 per cent. in 1926 and by 5–15 per cent.

in 1927 ; and *Phytodecta fornicatus*, Brügg., the larvae of which caused serious damage to lucerne, which was also attacked by *Otiorrhynchus ligustici*, L., *O. lavandus*, Germ., *Sitona crinita*, Hbst., *S. lineata*, L., *Polydrosus cervinus*, L., and *Opatrum sabulosum*, L. Sugar-beet was attacked by *Chromoderus* (*Cleonus*) *fasciatus*, Müll., *Bothynoderes* (*C.*) *punctiventris*, Germ., *Chaetocnema concinna*, Marsh., *C. tibialis*, Illig., *Psylliodes attenuata*, Koch, *P. chrysocephala*, L., and *Phyllotreta* sp. The most serious pest of hops in 1926 was *Phorodon humuli*, Schr., whereas in 1927 the worst damage was caused by *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.). Other pests of hops included *C. concinna*, *Phyllotreta nemorum*, L., *P. vittula*, Redtb., *Lecanium robinarium*, Dougl., and *Neoplinthus* (*Plinthus*) *porcatus*, Panz. Flax and hemp were attacked by flea-beetles, *L. robinarium* and *P. nubilalis*, and sunflowers by *Homoeosoma nebulella*, Schiff., which destroyed 50 per cent. of the seeds in 1926.

Pests of plums included *Lecanium corni*, Bch., and *Hyalopterus arundinis*, F. (*pruni*, Koch), which weaken the tree and are followed by *Scolytus mali*, Bech. (*pruni*, Ratz.), *S. rugulosus*, Ratz., and *Xyleborus dispar*, F. ; *Hoplocampa fulvicornis*, Panz, which causes serious damage to the young fruit ; *Rhynchites* spp., *Phyllobius* spp., *Polydrosus* (*Metallites*) *sericeus*, Schall., and *Hyponomeuta variabilis*, Zell. Apples were infested by *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., *Hyponomeuta malinellus*, Zell., and *Anthonomus pomorum*, L. Pears, which are less widely cultivated than plums or apples, were attacked by *Anthonomus cinctus*, Redtb., *Byctiscus betulae*, L. (*Rhynchites betuleti*, F.), *R. aequatus*, L. (*purpureus*, Goeze), *R. giganteus*, Kryn., and *R. bacchus*, L. Young flower buds of pear, cherry, red currant, gooseberry and grape are severely damaged every year by *Polydrosus cervinus* and *P. mollis*, Stroem. *Myzus persicae*, Sulz. (*Rhopalosiphum dianthi*, Schr.) is the most serious pest of peach. Red currants and gooseberries are also attacked by *Abraxas grossulariata*, L., *Pteronus* (*Nematus*) *ribesii*, Scop., and *Aegeria* (*Sesia*) *tipuliformis*, Cl. Vine pests included *Otiorrhynchus ligustici* and *O. lavandus*, which occur in light rather than heavy soil, and cause more damage than any other pest of the vine ; *Polydrosus cervinus*, which is abundant along the Danube ; and *Clysia* (*Conchylis*) *ambiguella*, Hb., *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., *Lethrus apterus*, Laxm., *Helops quisquillius*, Strm., and *Galeruca rufa*, Germ.

Sprengel (L.). **Studien über die Eiablage des einbindigen Traubenwicklers** (*Clysia ambiguella* **Hbn.**) **innerhalb eines Massenfluges.** [Studies on the Oviposition of *C. ambiguella* during an Outbreak.]—*Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 42–49, 2 charts, 4 refs. Berlin, 1929.

Previous morphological and physiological studies of several species of Lepidoptera have dealt with the conditions in the ovaries of female moths previous to oviposition in relation to varying longevity and fixed differences between individual species [*R.A.E.*, A, xvi, 372, 496]. The present studies, which were made by observation on moths taken in glass bait traps, were confined to *Clysia ambiguella*, Hb. This moth is particularly suitable for such a study, as it has two generations a year, each characterised by distinct features, is comparatively free from parasites and is sensitive to meteorological factors.

The examination of 265 females of *C. ambiguella* taken from 13th July to 4th August 1927 showed that only about $\frac{1}{8}$ of the total had failed to oviposit. The proportion of males and females was about equal on 17th and 18th July, but females tended to preponderate later. In a second series of observations, carried out from 3rd May till 4th June 1928, the moths were taken from the plants early in the morning and placed in tubes in the laboratory. Most of the eggs were laid between 7th and 11th May, the maximum flight occurring in the field between 6th and 8th May. Hitherto this flight has been considered a mating flight, followed a few days later by oviposition, but the present observations show distinctly that it is an oviposition flight. It is suggested that during the mating flight that probably precedes the oviposition flight the moths do not visit the glass bait traps. If this is the case, the reliability of the glass bait trap method is much greater than has hitherto been supposed, and will admit of much more exact calculation of the moment suitable for the application of control measures.

ZACHER (F.). **Neue Wege zur Bekämpfung der Vorratschädlinge.** [New Methods for controlling Pests of Stored Products.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 49–55, 1 fig. Berlin, 1929.

An account is given of the progress made in control methods used against pests of stored products since the author's previous review of the subject in 1924 [*R.A.E.*, A, xiii, 63]. Good results have been obtained against *Calandra granaria*, L., with various chemical dusts based on copper carbonate, mercury or arsenic [xv, 374]. In experiments with light traps for *Ephestia elutella*, Hb., the moths captured were chiefly males or females that had already oviposited. Among attractants tested in a cacao warehouse, the best results were secured with amyl acetate diluted with water at the rate of 558 : 100. The effect of other oils, such as oil of cassia or nitro-benzol, was very little greater at low concentrations than that of water alone, but at greater strengths they were distinctly repellent. Amyl acetate was also observed to act as a strong attractant to *Niptus hololeucus*, Fald. A short account is given of the effect of packing on infestation by insect pests [xvi, 216].

In experiments with Röntgen rays, eggs of *C. granaria* and *E. elutella* 1 to 2 days old were killed by exposure to unfiltered rays, with 195 kilovolts, 195–1150 mA-minutes, and a distance from the focus of the tube to the treated surface of 19 cm. Eggs of *C. oryzae* were killed with 100 kilovolts, 240 mA-minutes, and a distance of 20 cm. In a second series of experiments, tubes with copper anodes and Lindemann windows or Wolfram tubes with copper or aluminium filters were employed. The best results were secured with the soft rays, 800 Röntgen units of which were more effective against the eggs of *C. granaria* than 2,000 units of the hard rays. Small doses (200–400 units) had a stimulating effect on the younger eggs, increasing the rapidity and percentage of hatching. Eggs mature for hatching were not affected by the rays.

Fumigation with ozone is likely to prove a satisfactory method of controlling insects infesting machinery and transport tubes in foodstuff

factories. The effect of this fumigant is a very gradual suppression of the development of the insects. Strong doses (7–10 mg. per cubic metre), which are in some cases dangerous to the health of the workers and to the quality of the goods, killed 90 per cent. of the young larvae and 100 per cent. of the older larvae of *Ephestia kühniella*, Zell., in 14–28 days. One-twentieth of this concentration had no effect on the young larvae, but considerably increased the mortality among the older ones.

ZACHER (F.). **Nahrungsauswahl und Biologie der Samenkäfer.** [Food Selection and Biology of the Bruchidae.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 55–62. Berlin, 1929.

Most of the information contained in this paper has already been noticed from an abridged version [*R.A.E.*, A, xvii, 134]. The factors governing females of *Spermophagus subfasciatus*, Boh., in plant selection for oviposition are obscure, but the sense of smell is probably one and palpation another, since preference is shown for large seeds and seeds with injured seed-coats are rejected. The number of eggs laid on beans of varying sizes was observed to increase in proportion to the size of the bean at a temperature of 28° C. [82·4° F.], though the increase was less marked at 18–20° C. [64·4–68° F.]. At the optimum temperature, 71 eggs were laid on a bean weighing 9 gms. as compared with 317 eggs on one weighing 16·3 gms., whereas at room temperature the corresponding numbers of eggs were 91 and 162. All species bred by the author, which included *Bruchus* (*Pachymerus*) *chinensis*, L., *B. analis*, F., and *B.* (*Acanthoscelides*) *obtectus*, Say, were able to mate and oviposit without feeding as adults, the Bruchids carrying sufficient food in the form of a large fat-body from the larval stage through the pupal stage to enable them to reach maturity without taking further food. Details are given of the rate of decrease in weight consequent upon the absorption of the fat-body. Although feeding in the adult state is not essential to reproduction among Bruchids, it may nevertheless occur. *S. fasciatus*, though never observed to consume solid food, drank water and diluted honey freely, subsequently producing eggs at a slightly increased rate.

ZWEIGELT (F.). **Gallenbildung und Spezialisation.** [Gall Formation and specific Adaptation.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 62–76, 11 figs. Berlin, 1929.

The influence exercised by food on the development of insects, the importance of which was demonstrated by Börner in respect of retarded or suspended development in *Phylloxera* [*R.A.E.*, A, xv, 675], is further studied in regard to the adaptation of Aphids to specific food-plants as leading to biological and morphological differences and eventually to racial and specific distinctions. Observations of the galls of *Tetraneura ulmifoliae*, Baker (*ulmi*, L.) and *Eriosoma* (*Schizoneura*) *ulmi*, L., on various forms of *Ulmus montana* showed that *E. ulmi* is not so far advanced in its adaptation to give rise to subspecies as *T. ulmifoliae*. The possible protective function of the galls, the mechanism by which they open, their physiological construction and development, and the

changes effected by them in the plant are discussed. The galls are considered to be reactions of the plant that cause the insect to diverge further and further from its original mode of life, finally causing it to depend on one particular type of gall. Gall formation results in immunity in the plant and specialisation to one food-plant in the insect.

KOMÁREK (J.). **Nonnenbekämpfung mit Flugzeugen im Gebirgsterrain von Schlesien.** [Control of the Nun Moth by means of Aeroplanes in a Mountain District in Silesia.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 81–86. Berlin, 1929.

An account is given of aeroplane dusting to control the nun moth [*Lymantria monacha*, L.] in mountainous country in Silesia adjoining Moravia, where serious damage was caused in 1926. In view of the extremely difficult surface to be treated, two small machines were selected, capable of rising and landing on small areas and carrying only about 450 lb. dust. Calcium arsenate was applied at the rate of about 30 lb. to the acre, a quantity that, although insufficient to effect complete control, will check the ravages of the larvae until polyhedral disease is far enough advanced to account for the remainder. As wind was rarely avoidable, the use of a heavy dust that settled quickly was found advantageous. An early application of the dust is recommended to prevent serious damage and to avoid bad weather conditions that prevail later in the year. After the larvae, which were present at the rate of 5,000 to a tree, had already killed several spruces in June, their numbers were reduced by aeroplane dusting to such an extent that no further injury was visible. A repetition of the treatment in the following year, combined with the effect of polyhedral disease, completely exterminated the larvae at a total cost of about 19*s.* an acre.

BORCHERS (F.). **Die Haftfähigkeit von Spritz- und Verstäubungsmitteln.** [The Adhesiveness of Sprays and Dusts.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 86–94. Berlin, 1929.

Several instances are quoted to show that the results secured by the methods hitherto in use for the determination of the adhesiveness, etc., of dusts and sprays [*R.A.E.*, A, xii, 54 ; xiii, 469 ; xiv, 193 ; xv, 646, etc.] are not sufficiently accurate. As most of the insecticides containing calcium arsenate are mixed with a carrier or some diluent, there is always a danger that the constituents will separate out when the mixture is subjected to any of the current tests. The results are therefore inaccurate and the methods valueless unless accompanied by a chemical analysis of the material adhering. A comparison between the adhesive qualities of various sprays can be accurately arrived at by means of a method which is described, whereby the adherent materials are weighed and the quantity of the effective element present to a given area is calculated in the case of each. Dusts are tested in a similar manner, the apparatus already noticed [xv, 646] being used, with talc dust as a standard of comparison.

WILLE (J.). **Die Rübenblattwanze** *Piesma quadrata,* **Fieb., ihre Bedeutung als Schädling und ihre Bekämpfung.** [*P. quadrata,* its Status as a Pest and its Control.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928,* pp. 94–101, 9 refs. Berlin, 1929.

A brief account is given of the systematic position of *Piesma quadrata,* Fieb., its wide distribution in Europe as compared with the small area in which it is injurious in Germany and its migration from wild to cultivated plants. The stages of this Tingid are described, its life-history is briefly outlined [*R.A.E.*, A, x, 501 ; xvi, 1], and its relation to leaf-crinkle disease of beet is discussed [xvi, 591]. Three distinct forms of the disease have been recognised, a severe and progressive form starting early in the year, a similarly severe form interrupted by normal periods of growth, and a slight form starting much later. The most effective method of control is to destroy the bugs by means of insecticides in the tufts of grass and litter in which they hibernate, attempts to burn the grass, etc., having proved ineffective.

KRIEG (—). **Beiträge zur Verwendung des Bleiarseniats in Deutschland.** [Notes on the Application of Lead Arsenate in Germany.]— *Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928,* pp. 101–103, 16 refs. Berlin, 1929.

The prohibition in force against the use of lead arsenate in German vineyards in spring is discussed, and the reasons advanced in favour of its enforcement are discounted, in view of the absence of cases of poisoning in countries where this insecticide is employed. No authenticated case of poisoning has ever been traced to insecticides containing lead in Germany. Doubt is cast on the accuracy of the analyses of residues where these are carried out by persons other than experienced chemists, and instances are given of conflicting results being returned by different institutions from tests of the same sample.

Bericht über die VII. Mitgliederversammlung der Deutschen Gesellschaft für angewandte Entomologie in München vom 31. Mai bis 2. Juni 1928. [Report of the 7th Meeting of the German Society for Applied Entomology in Munich, 31st May–2nd June 1928.]— *Anz. Schädlingsk.*, iv, no. 7, pp. 91–101. Berlin, 1928.

Brief reports of papers read at this meeting, but not published in the foregoing series, are noticed below.

The immunity of plants from insect pests and fungous diseases is discussed by Börner, with particular reference to experiments in the immunity of the vine from *Phylloxera.* Certain similarities in the phenomenon of immunity and its heredity in plants are pointed out in respect of *Phylloxera* and rust fungus. Details are given of various classes of susceptibility of the vine to *Phylloxera,* which correspond to those of wheat to brown rust fungus. A distinction is drawn between passive and active immunity, the former term being applied to cases in which the ferments produced by the insects fail to act as an irritant to the tissues of the plant, such as occur when an insect is transferred

to a plant other than its true food-plant. In the case of active immunity the ferments of the insect exhibit diastatic and proteolytic qualities and probably act upon the food-plant as an irritant in such a manner as to create a stream of food in cases of susceptibility, and in cases of resistance and immunity produce a poisonous action in the affected plant tissues. Studies of the immunity of the vine from *Phylloxera* have disclosed the existence of nine factors of immunity or resistance. The ideal grafting stock, immune against all races of *Phylloxera*, can only be obtained by means of cross-breeding, complete immunity of the leaf having been secured by this method in Naumburg.

In a discussion on the breeding of Hymenopterous parasites on a large scale, Hase gave a brief account of the aims and organisation of the Laboratory for Physiological Zoology of the State Institute of Biology. The biological method must be considered as only one of many branches of insect control, and its value must be decided in each individual case by an exhaustive series of experiments both in the laboratory and in the field. An account is given of large scale breeding in the laboratory of both pests and parasites over a number of years.

G. Kunike contributed notes on the biology of *Achroia grisella*, F. (small wax moth), the stages of which are briefly described. The proportion of males and females is about equal. The total life-cycle lasts about 2–3 months. The adults do not feed. The eggs are laid singly or in groups of 250–300 and hatch in 5–10 days according to the temperature. The larvae feed on the wax cells of the honeycomb or on fragments of wax on the floor of the hive. The pupal stage is passed in a cocoon and lasts 8–14 days. Experiments with the larvae showed that they can develop entirely on peptonised pollen, pupal cases, etc., without feeding on wax, or entirely on wax without the addition of these materials. *A. grisella* requires hive temperature to complete its development, the eggs developing only between 15 and 31° C. [59–88° F.], and the larvae dying when subjected to temperatures lower than 9° C. [48° F.] and pupating only between 20 and 30° C. [68–86° F.]. The adults can only survive temperatures of over 34 or under 1° C. [93 and 34° F.] for a very short time. No attack followed the infection of an experimental hive with 200 adults and 100 larvae, so that infestation appears to indicate the presence of weakness or disease among the bees.

An account of the present status of hydrocyanic acid gas in the control of pests is given by Rasch [*cf. R.A.E.*, A, xvii, 206].

GESCHER (C.). **Zur Bekämpfung der Blutlaus.** [Control of the Woolly Aphis.]—*Die kranke Pflanze*, vi, no. 6, pp. 117–118. Dresden, June 1929.

It is suggested that espalier apple trees in Germany may be freed from the woolly aphis [*Eriosoma lanigerum*, Hausm.] by placing adhesive bands, about 2–3 fingers wide, in immediate contact with the bark, below the branches around the root-collar. The bands should be applied early in May and renewed early in September. This practice should be continued for 2 or 3 years. Most of the hibernating Aphids occur on or near the root-collar, but a few are to be found under the bark or in cracks in the stem.

SCHMIDT (M.). **Beobachtungen an** *Pentatoma rufipes* **L. (Hem., Pentat.).** [Observations on *P. rufipes*.]—*Z. wiss. InsektBiol.*, xxiv, no. 4–5, pp. 189–191. Berlin, 8th May 1929.

Pentatoma rufipes, L., is common on fruit trees in certain districts to the west of Berlin, causing a disagreeable taste in the fruit, which is especially noticeable in sweet cherries. It also injures the fruit and leaves, apples and pears being deformed. The adult bugs appear about mid-July and remain until early October on the trees. The larvae hatch in autumn and hibernate under the bark of the trees, etc., becoming active again in spring and sucking the bark until the leaves appear.

ZATTLER (F.). **Die wichtigsten Hopfenkrankheiten und ihre Bekämpfung.** [The most important Diseases of Hops and their Control.]

KORFF (G.) & ZATTLER (F.). **Die Prüfung von Bekämpfungsmitteln gegen die Krankheiten des Hopfens im Jahre 1928.** [The Testing of Fungicides and Insecticides for Hops in 1928.]

KORFF (G.) & BÖNING (—). **Bericht über das Auftreten von Krankheiten und Schädlingen im Obst- und Gartenbau im Jahre 1928.** [Report on the Occurrence in Bavaria of Diseases and Pests of Orchard and Vegetable Crops.]—*Prakt. Bl. Pflanzenb.*, vi, no. 4, pp. 85–92 ; vii, no. 1, pp. 8–14, 15–19. Freising, 1928, 1929.

These popular reports include brief discussions of the insects attacking hops, fruit trees and vegetables in Bavaria, with notes on their control.

[TULAĬKOV (N.).] **Тулайков (Н.). Work of the Entomological Section.** [*In Russian.*]—*Short Rep. Lower Volga Reg. Agric. Expt. Sta. 1927–28*, pp. 35–36. Saratov, 1929.

The work of the Entomological Section of the Lower Volga (formerly Saratov) Experiment Station during the year 1927–28 is briefly reviewed. In the course of a study of the Capsid, *Orthocephalus brevis*, Panz., which infested spring-sown wheat, it was found that it hibernates in the egg stage in the stems of *Bromus secalinus* and then migrates to the wheat.

[SAKHAROV (N.).] **Сахаров (Н.). Die Bedeutung der schädlichen Insekten für die Senfpflanze und die zum Kampfe mit ihnen möglichen Massnahmen.** [The Importance of Insects injurious to the Mustard Plant and possible Means of their Control.] [*In Russian.*]—*Zh. opuitn. Agron. Yu.-Vostoka*, vii, no. 1, pp. 53–69, 7 figs., 1 ref. Saratov, 1929. (With a Summary in German.)

Mustard, which is an important crop in the Saratov Government, is often considerably damaged by insect pests. A study in the spring and summer of 1928 showed that over 50 species of insects are involved, *Phyllotreta* spp. being the most important. The species concerned include *P. cruciferae*, Goeze, *P. atra*, F., *P. undulata*, Kutsch., *P. nemorum*, L., *P. schreineri*, Jacobs, *P. diademata*, Foudr., and *P. vittula*, Redtb., all of which have two generations a year and attack the plants from the moment of sprouting till the ripening of the seeds. Other pests in order of their importance are *Plutella maculipennis*, Curt.,

Athalia colibri, Christ, *Colaphus hoefti*, Fald., *Evergestis extimalis*, Scop., *Pieris daplidice*, L., *Eurydema ornatum*, L., *Poeciloscytus cognatus*, Fieb., *Lixus ascanii* var. *albomarginatus*, Boh., *Brevicoryne* (*Aphis*) *brassicae*, L., *Entomoscelis adonidis*, Pall., various beetles of the genera *Omophlus*, *Lydus*, *Podonta*, *Cetonia* and *Mylabris* (*Zonabris*), and the larvae of *Loxostege* (*Eurycreon*) *sticticalis*, L., which sometimes destroy whole fields of mustard. Short notes are given on the bionomics of each pest, and the damage done is briefly reviewed. The relation existing between the injury caused to the foliage of mustard and the ultimate crop of seed is discussed in detail, the decrease in the crop being in direct proportion to the number of the damaged leaves. The plants in which only the lower leaves were injured gave a satisfactory crop.

Spraying with 1 lb. sodium arsenite and 3 lb. unslaked lime to 120 gals. water, or with 1 lb. Paris green and 3 lb. lime to 90 gals. water, killed all the larvae of *A. colibri* and those of a few Lepidoptera, and resulted in a considerable increase of the crop, but had no effect on the flea-beetles. Dusting with calcium arsenate killed the flea-beetles, as well as other pests, within 12–24 hours; the poison adhered well to the plants and was not washed off by light rains. The author suggests that combined spraying and dusting might be the best measure; he also recommends experiments on the best time for sowing mustard in order to avoid severe infestation by the various pests.

[Vasil'ev (I. V.).] **Васильев (И. В.). Is it necessary to control Leaf** *Phylloxera?* [*In Russian.*]—*Vestn. Vinodel. Ukrainui*, xxx, no. 5, pp. 262–265, 2 figs., 6 refs. Odessa, May 1929.

This is a popular discussion on the importance of leaf infestation by *Phylloxera*, which sometimes forms galls on the stems and tendrils also; it is pointed out that American vines and some of the ungrafted hybrids suffer the most. Intense infestation retards the growth of the vines, reduces the number of grapes and affects their quality. The leaf form of *Phylloxera* increases very rapidly, but the chief danger consists in the fact that the last generations of the pest produce root larvae that may infest adjoining healthy vineyards. The conditions in the Ukraine and Moldavia are very favourable to a wide and rapid spread of infestation, as the vines usually cultivated there are ungrafted hybrids.

The measures recommended by various authors are briefly reviewed [*R.A.E.*, A, xvi, 101, 470; xvii, 339], and the method of destroying the galls by removing the very young leaves bearing the first galls is recommended; this should be done about the middle of May and repeated in 7–10 days.

As the winter eggs are not laid on the smooth one-year-old shoots of vines, but only on the stems and older branches with rough cracked bark, these should be carefully covered with earth for the whole period during which the winged forms occur, which in the Odessa region lasts from the middle of July till the middle of October, and in Moldavia from the middle of August till the beginning of October; vines treated in this way will not be infested by leaf galls in the spring.

The application of paradichlorobenzene to the upper layer of the soil during the period of the development of the nymphs that produce the winged forms is considered too complicated and expensive.

[Nevskiĭ (V. P.).] **Невский (В. П.). The Aphids of Central Asia.** [*In Russian.*]—[*Pub.*] *Uzbekistan Expt. Plant Prot. Sta.*, no. 16, 424 pp., 108 figs., 44 refs. Tashkent, May 1929. Price *Rbl.* 7.

This is a guide to the Aphid fauna of Central Asia, especially that of Uzbekistan, and deals only with the family Aphididae in the restricted sense, including the subfamilies Aphidinae and Pemphiginae. In the first part of the book the structure of Aphids, all the aspects of their bionomics and their economic importance are discussed in detail, and instructions are given for the collection and preparation of specimens, together with a list of the Aphids infesting the roots of various plants. The second part contains keys to the tribes, genera and species, 210 species being included, with notes on their bionomics, time of occurrence and food-plants. Several new species are described, of which only two are recorded on important crops, *viz.*, *Aphis flava*, on the lower surface of the leaves of cotton, potatoes and cucurbits, and *Anuraphis* (*Dentatus*) *plumbicolor*, on the leaves of apple.

A list of food-plants and an index to the genera and species of Aphids dealt with in the book are appended.

[Benua (K. A.).] **Бенуа (К. А.). Fungous Diseases of Acrididae. A Summary of published Data and Report.** [*In Russian.*] —8vo, 49 pp., 18 figs., 7 pp. refs. Leningrad, State Inst. Exptl. Agron., Lab. Mycol. & Phytopath., 1928.

A list is given of all the species of fungi that have been described as parasites or saprophytes on Acrididae, with references to the original descriptions, short diagnoses and biological notes.

The author investigated egg-deposits of *Locusta* (*Pachytylus*) *migratoria*, L., in a number of localities in the northern Caucasus in 1927, but failed to find any definite data on the infection of eggs by parasitic fungi. Egg-pods containing some undetermined fungi appeared to have been mechanically damaged by insects and later infested by saprophytic fungi. No fungous diseases have been found among the larvae and adults of *L. migratoria*.

[Gerasimov (A. M.).] **Герасимов (А. М.).** *Numonia pyrivora*, **sp. n. (Lepidoptera, Phycitini) als Schädling der Birne in der Küstenprovinz Ost-Sibiriens.** [*In Russian.*]—*Rev. russe Ent.*, xx, pp. 127–135, 9 figs., 1 ref. Leningrad, 1926. (With a Summary in German.)

A detailed description is given of the larvae, pupae and adults of *Numonia pyrivora*, sp. n., an important pest of pears in the Russian Far East, where in 1925 it destroyed about 90 per cent. of the crop. The larvae begin to attack the fruits at the end of May, causing them to become black and shrivelled while still hanging on the tree. Pupation occurs inside the pears, and the adults emerge at the end of June. The only parasite observed was *Pimpla bernuthi*, Htg., the rate of parasitism in 1925 being 20 per cent.

[Gerasimov (A. M.).] **Герасимов (А. М.).** *Numonia pirivorella* **Mats.** = *Nephopteryx pirivorella* **Mats.** = *Numonia pyrivora* **Geras.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, p. 677, 1 ref. Leningrad, 1929.

The author states that *Numonia pyrivora*, Geras. [see preceding paper] is synonymous with *Nephopteryx pirivorella*, Mats., recorded as attacking pears in Japan, but that it is correctly referred to the genus *Numonia*.

[Nevskiĭ (V. P.).] **Невский (В. П.).** *Rhynchites auratus* **Scop.** *ferganensis*, **subsp. n., ennemi de l'abricot au Ferghana.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 443–473, 5 figs., 2 diagrs., 3 refs. Leningrad, 1929.

A detailed account is given of observations made from 1924 to 1927 on *Rhynchites auratus ferganensis*, subsp. n., which is a pest of apricots in the Isfarah valley, Ferghana, where it destroys over 50 per cent. of the crop each year. The typical *R. auratus*, Scop., which is smaller and has a shorter proboscis, occurs on cherries and almonds in other parts of Ferghana, but does not attack apricots. *R. auratus ferganensis* has one generation a year, hibernating in the adult stage in the soil. The weevils appear on the surface from the second half of March till the middle of May. They are able to fly and soon begin to attack the swelling buds, flowers, leaves and green fruit of apricot, but feed exclusively on the ovaries of the flowers, when these are available, being particularly active on warm, sunny days. They prefer trees over 40 years old and are more abundant in sheltered orchards.

Oviposition begins in the second half of April and is especially intense at the end of the month and beginning of May. It lasts about 34 days and is interrupted or retarded by cold and rainy weather. One female lays 84–112 eggs, usually depositing them on the stones of the fruit, though at the end of the oviposition period, some are laid in the pulp, where they usually die. The adults begin to decrease in number from about the middle of May, and all are dead by the end of June.

The larvae hatch in 8–12 days and after remaining for some days on the stone of the fruit, gradually penetrate into the kernel. If the infested fruit falls to the ground, only those that have already made their way into the kernel survive. Two or three larvae occurring in one fruit only develop if their cells remain distinct; otherwise one destroys the other. After remaining in the fruit for about a month they enter the soil. It was found that 66 per cent. of the larvae that enter the soil have dropped from apricots still hanging on the trees. A gradual increase occurs in the mortality of the eggs and larvae, the chief cause of this being the overcrowded conditions under which the weevils breed, and numbers of the larvae, pupae and young adults die in the soil from unknown reasons. A Trichogrammatid parasite that infests the eggs of *R. auratus* on cherries cannot attack those of *R. auratus ferganensis* in apricots as its ovipositor is too short.

When the larvae have entered the soil, they prepare a cell at a depth of 2–3½ ins. in which they remain for 53–78 days before pupating. Observations showed that 44 per cent. of the larvae do not pupate till the beginning of September in the following year, and this makes the control of the weevil very difficult. The first pupae occur at the end

of July and are abundant from the beginning of August till about 10th September. The pupal stage lasts on an average 18–20 days, but the young weevils remain in the pupal chambers till the beginning of March.

Various control measures tested in orchards and in the laboratory are reviewed in detail. Spraying with 2 lb. barium chloride to 3 gals. water and dusting with equal parts of sodium arsenate and lime killed only 50 per cent. of the weevils, while spraying with Paris green was still less effective. Carbon bisulphide, 10½ oz. to each square foot of soil, killed only 15 per cent. of the pupae and young adults and a smaller proportion of the larvae. Shaking the weevils from the trees considerably reduced their numbers when repeated not less than 5–7 times, but also caused many uninfested fruits to fall. Ploughing kills the pupae, but not the larvae or adults in the soil; two ploughings about 15th August and 1st September are therefore recommended. Daily collection of the fallen fruit in June is useful as a supplementary measure.

Complete eradication of the weevil might be effected by covering the ground under each apricot tree in the course of June with linen sheets in order to prevent the larvae from entering the soil, this being done simultaneously in all the infested orchards for two consecutive years.

[Zorin (P. V.) & Zorina (L. M.).] **Зорин (П. В.) и Зорина (Л. М.). Contributions à la biologie de la *Polia oleracea* L.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 475–486, 16 figs., 20 refs. Leningrad, 1929.

An account is given of observations on *Polia oleracea*, L., carried out near Leningrad from 1922 to 1928. Only occasional individuals occurred in the first year, but their numbers steadily increased, so that the insect became particularly abundant in 1925 and 1926. All stages are described, and the eggs and larvae are compared with those of *Polia suasa*, Schiff. (*dissimilis*, Knoch). The adults emerged from mid-June to mid-July, and most of the eggs were laid in July and the first half of August. They were deposited in batches on the underside of the leaves of a variety of plants. In the laboratory the moths lived about 4 weeks, and some laid over 1,000 eggs. The egg stage lasted 10–12 days in the field, but about 8 in the insectary at a temperature of 20° C. [68° F.]. The larvae chiefly attacked beet and cabbage, of which they damaged only the outer leaves, but also infested a number of other cultivated plants and weeds, a list of which is given. Those that hatched in July developed in 35–40 days, whereas those that hatched in August required 6–8 weeks. They pupated in the soil at a depth of about an inch, but entered a diapause prior to pupation. Hibernation occurred in the pupal stage. When the larvae were bred at a temperature of 27° C. [80·6° F.] and a humidity of 45–50 per cent., the pupal stage lasted only 2–3 weeks; such pupae even when exposed to temperatures of about 10–12° C. [50–53·6° F.] continued to develop, and when they were brought into a warm environment adults soon emerged.

Trichogramma evanescens, Westw. [*cf. R.A.E.*, A, xvi, 43] infested the eggs of *P. oleracea*, and *Microgaster marginatus*, Nees, attacked the larvae shortly before they hatched. In 1925 not less than 12 per cent.

were parasitised by this Braconid, the larvae of which abandoned those of the host when the latter were in the fourth or fifth instar, and hibernated in cocoons. The other parasites observed all infested the larvae in various instars. *Apanteles affinis*, Nees, 10–25 larvae of which occurred in a single host, *Anilastus coxalis*, Brischke, and *Sagaritis erythropus*, Thoms., spin cocoons on the lower surface of the leaves. A partial second generation of *A. affinis* emerged in August, and the other two had two complete generations a year. *Henicospilus ramidulus*, L., *Ophion luteus*, L., *Exetastes cinctipes*, Retz., *Banchus volutatorius*, L., and *B. obscurus*, Meyer, only abandoned the larvae when they had entered the soil, after which the parasites constructed cocoons in which they hibernated. *Eulophus pectinicornis*, L., paralyses the mature larvae of *P. oleracea*; it hibernates in the pupal stage and has two generations a year. *Anomalon cerinops*, Grav., also infests the mature larvae, but hibernates in the cocoon of the host.

Ernestia consobrina, Mg., oviposits on the foliage of the food-plants of *P. oleracea*; the larvae leave the host in the soil and hibernate in the pupal stage. In 1925 about 9 per cent. of the larvae of *Polia* were infested by this Tachinid. *Lydella nigripes*, Fall., hibernated in the pupae of the host, which it abandoned in the spring for pupation.

Barichneumon (*Ichneumon*) *fabricator*, F., and *Voria trepida*, Mg., were only once reared from *P. oleracea*; the latter hibernated in the pupal stage in the soil.

A list of the parasites recorded by other authors is given.

The larvae of *P. oleracea* were also killed by the fungus, *Oospora destructor*, and the pupae by *Bacillus alvei*.

A gradual decrease of the moth in the Leningrad district has been observed since 1927, probably owing largely to the parasites, particularly *M. marginatus*, and to the damp and cold weather.

[Znoĭko (D. V.).] **Знойко (Д. В.). Matériaux sur la distribution géographique des hannetons (Coleoptera, Melolonthinae) dans la province d'Odessa.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 487–495, 13 refs. Leningrad, 1929.

This is a systematically arranged list of 40 species of Lamellicorn beetles that have been recorded in the Odessa region, with notes on their local distribution and the time of the mass appearance of the adults. The species of most economic importance are *Rhizotrogus aequinoctialis*, Hbst., *R. aestivus*, Ol., *Amphimallus solstitialis*, L., *Melolontha melolontha*, L. (*vulgaris*, F.), *Polyphylla fullo*, L., *Anomala praticola*, F., *A. aenea*, DeG., *Anisoplia segetum*, Hbst., and *A. lata*, Er.

[Shchelkanovtzev (Ya. P.).] **Щелкановцев (Я. П.).** *Biston strataria* **Hufn. dans les forêts du gouvernement de Voronezh.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 497–503, 1 fig., 2 refs. Leningrad, 1929.

Biston strataria, Hufn., which appeared in the Voronezh Government in 1920, caused severe damage to oak forests in 1926 and 1927. In 1928, adults were on the wing from 24th April till the middle of May. Oviposition probably occurred on the upper parts of the tree trunks, and dissections showed that a female may lay as many as 1,000 eggs. The larvae appeared at the beginning of June and pupated in August

in the ground litter or in the upper layer of the soil. Hibernation occurs in the pupal stage. The larvae and pupae are described in detail.

In 1926, and especially in 1927, large numbers of the larvae were destroyed by a bacterial disease similar to flacherie ; in 1928 the infestation subsided owing partly to this disease, which was favoured by cold and rainy weather, and partly to the predacious Carabid, *Calosoma inquisitor*, L., which was very abundant. The marked increase of *B. strataria* during the dry years 1920–24 was due to the comparative thinness of the forests, conditions favourable to the larvae and pupae resulting from the sunlight that penetrated the trees. Bacterial infections began to develop in 1925, when meteorological conditions changed and rains were frequent and abundant. The injured trees often became reinfested by secondary pests, such as the larvae of *Cerambyx scopolii*, Füssl., *Haplocnemia* (*Mesosa*) *nebulosa*, F., and a species of *Agrilus*, probably *A. biguttatus*, F., although the type of gallery appears to be rather different. Adults of *Xyleborus* (*Anisandrus*) *dispar*, F., were very abundant in some parts of the forest.

The measures recommended against *B. strataria* are the use of light traps in spring, and the removal of the litter from under the infested oaks with subsequent digging of the soil. In felling, dense belts of trees should be left, with wide vistas between them.

[Amirashvili (E. A.).] **Амирашвили (E. A.). Contributions à l'étude de la biologie de** *Polychrosis botrana* **Schiff.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 505–514, 5 refs. Leningrad, 1929.

The history and distribution of *Polychrosis botrana*, Schiff., in Europe are briefly reviewed, and a detailed account is given of observations on it carried out in 1920 and 1921 in Georgia, where there are three generations a year. Only certain varieties of vines are attacked. A list of its food-plants is given ; in Georgia it often occurs on *Daphne gnidium*.

Adults from the overwintering pupae are on the wing by the end of April and beginning of May. The eggs are laid on the flower buds and hatch in 5–6 days or more, according to the temperature. Before feeding on a cluster of buds, the young larva spins a web round it. The number of damaged buds is greater if their development is retarded by cold and damp weather. Manuring promotes the flowering of the vines and raises their resistance to infestation. The larvae feed on the buds for about 3 weeks and then pupate in cocoons either in the bud clusters, which fall off soon after the emergence of the adults, or under the rolled edges of leaves. The pupal stage lasts 12–15 days. The resulting adults oviposit on the fruit, generally in the second half of July, the eggs being laid singly. Dissection showed that a female may lay 50–60 eggs. The larvae hatch in 4–5 days and penetrate the grapes, one to each fruit, preferring those on the shady side of the bunches. Bunches in which the berries do not touch one another suffer less than dense ones. The infested berries shrivel and in wet years become rotten. The larvae develop more quickly than those of the preceding generation. They pupate inside the dried berries, a cocoon being sometimes formed, or more rarely between the berries in a bunch. The pupal stage lasts 8–10 days, but a few pupae may hibernate. In 1920, the adults were on the wing in the middle of August.

Eggs of this generation are abundant at the beginning of September and hatch in 4–5 days. The larvae feed only on the part of the pulp immediately under the skin of the grape, and migrate from one berry to another. They frequently spin nests amongst the berries, and only a few pupate before harvest, which in dry years takes place in the middle of September, so that most of them are gathered with the grapes. Some escape, however, by dropping to the ground on silken threads and others are left in fallen fruit. Pupation and hibernation take place in cocoons among fallen leaves, in berries or cracks of the soil, or under the bark of the vines.

Natural enemies of *P. botrana* include birds and spiders and several species of Hymenopterous parasites. For control, it is recommended that some of the leaves should be picked before each oviposition period, or the vines trained on espaliers, in order that the eggs may be exposed to the sun and killed.

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[Borodaevskiĭ (P.).] **Бородаевский (П.). Contributions à l'étude de la biologie des Scolytiens d'après les observations au gouvernement de Brjansk.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 515–521, 12 figs. Leningrad, 1929.

The author discusses the data on the bionomics of *Pityophthorus micrographus*, L., given by Spesivtzev and Korotnev [*R.A.E.*, A, xiii, 397, 464; xvi, 475] and points out that in some respects, such as the diameter of the trees attacked, the type and length of the galleries, and the average number of eggs laid, they differ from one another and from his own observations. In the Bryansk Government, *P. micrographus* has one generation a year. In 1926 the beetles attacked standing and fallen spruce early in May, hollowing out breeding chambers in the thin branches of the crown. Eggs and larvae occurred throughout May, June and July, by the end of which month the first young adults appeared; they were found in galleries throughout the whole of the autumn and in January of the following year.

Ips (*Orthotomicus*) *starki*, Spess., was observed to attack standing and fallen spruce, infesting branches 7–15 mm. thick on trees varying in diameter from 5 to 21 ins., and being accompanied by *P. micrographus*, *Ips* (*Pityogenes*) *chalcographus*, L., *Polygraphus* and sometimes, *Chermes abietis*, L. It occurred on the edges and in the centre [*cf.* xvi, 39] of pure stands of spruce, and also in mixed stands of pine and spruce, the trees being about 80 years old. Hibernation took place in the adult, larval and egg stages. A detailed description is given of the adult and larval galleries.

[Engel'hardt (V.).] **Энгельгардт (В.). Notice sur la** *Carpophilus hemipterus* **L. (Coléoptères, Nitidulides) nuisible au pain et aux autres vivres en Extrême Orient.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 543–547, 1 ref. Leningrad, 1929.

Carpophilus hemipterus, L., is an important pest of bread, biscuits and cooked rice in Nikol'sk-Ussuriĭsk and the adjoining area covering a radius of about 12½–15 miles. It is thought that this Nitidulid has probably been accidentally imported; it does not occur in Vladivostok or any other part of the Russian Far East. All stages are described. The adults are especially abundant from June till the end of September,

when they swarm in bakeries, etc. Infested bread and biscuits soon become mouldy.

Oviposition occurs in the galleries mined in the loaves, and the eggs hatch in 2 or 3 days. The larvae also mine in the loaves and pupate in the galleries, the larval and pupal stages each lasting about 10 days. Oviposition is protracted, and all the stages overlap. The habits of the beetles during the winter were not observed. The fact that swarms of adults flew into the laboratory, which was situated outside the town amidst orchards and fields, as soon as fresh bread and honey were brought in, and that in the insectary the larvae pupated in the soil, indicates that this Nitidulid is not exclusively a pest of stored products, but may also breed in the open field. Both adults and larvae readily fed exclusively on fermenting honey, and in the field they perhaps feed on the nectar of flowers or on the sap exuding from trees.

Windows of bakeries and shops should be screened with muslin to prevent the entry of the adults. It was found that many of them could be killed by baits of honey containing a small quantity of sodium arsenite.

[Ponomarenko (D. A.).] **Пономаренко (Д. А.). Résultats des observations sur la *Harmolita eremitum* Portsh. dans la République des Allemands du Volga inférieur en 1926.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 549–557. Leningrad, 1929.

Harmolita eremita, Portsch., occurs annually on winter rye in the region of the Republic of the Volga Germans, but the damage caused by it has always been considered to be insignificant [*cf. R.A.E.*, A, xvi, 666]. Special investigations on the question were, however, carried out in the summer of 1926. The borders of the fields are considerably more heavily infested than the centre, showing that this Eurytomid migrates to winter rye from adjoining fields where rye was grown in the preceding year, or from waste land covered with grasses, in which the larvae hibernate. Oviposition usually occurs in the lower parts of the stems, not higher than the third joint; the larvae mature and pupate there, and are not destroyed during the harvest, but hibernate in the stubble. Each stem usually harbours a single larva, but occasionally two or three may occur in different parts of the same stem. Some of the stems were infested by the larvae of *H. eremita* var. *nodalis*, Rim.-Kors., and those of the parasite, *Homoporus vassilievi*, Ashm., which appears to prefer this variety to the typical *H. eremita*. Only the best and strongest stems are infested, so that they produce a crop not inferior to that of the weaker ones, and this gives the appearance of a sufficiently good harvest from the infested parts of the field. Owing to the abundance and wide distribution of *H. eremita*, however, the loss caused by it is severe, analysis showing that the weight of grain produced is greatly diminished by infestation. Detailed estimates of this are given, and the amount of injury done in various localities is shown in tables.

[Kozhanchikov (L.).] **Кожанчиков (Л.). Contributions à la biologie du *Meligethes aeneus* Fabr.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 559–562, 1 ref. Leningrad, 1929.

Some observers consider *Meligethes aeneus*, F., to be a pest of cultivated crucifers, reducing the crop of seed [*R.A.E.*, A, viii, 542],

whereas others believe it to be a beneficial insect, as the larvae may cause self-pollination or play an important part as pollen-carriers [ix, 64]. Comparatively little is known of the biology of the larvae, since they live concealed in the buds and flowers of crucifers. Laboratory experiments, which are fully described, show that there is only one moult, larvae in the second instar pupating in the soil. The egg stage lasted 4 days, and the larval 6–13, depending on the state of maturity of the flowers. The larvae, both instars of which are described in detail, fed exclusively on pollen, and only when food was scarce did the more mature ones attack other parts of the flowers. In experiments in which crucifers were artificially infested with larvae and adults, the flowers being subsequently isolated with the insects until the formation of pods, only about 10 per cent. of the flowers were sterile, as compared with about 15 per cent. in uninfested plants. Further experiments proved that buds in which females had oviposited developed into flowers, and that the latter, although infested by larvae, produced pods. It is therefore concluded that *M. aeneus* can only become a serious pest when it is particularly abundant, and that it has a beneficial effect on the ultimate crop of seeds when the infestation does not exceed 25 per cent. of the buds and flowers.

[Pliginskiĭ (V. G.).] **Плигинский (В. Г.). Les ennemis du blé sarrasin.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 563–567, 1 ref. Leningrad, 1929.

To a list of 13 insect pests of buckwheat [*Fagopyrum*] recorded from the literature, the author adds three species observed by him in the Kursk Government, *viz.*, *Athous niger*, L., the larvae of which occurred together with those of *Agriotes lineatus*, L., *Lethrus apterus*, Laxm., found in spring attacking very young shoots, and *Chaetocnema concinna*, Mshm., previously recorded as a pest of beet and hops. In 1919 this flea-beetle caused severe damage to buckwheat in the Kursk Government, and it has since occurred every year, but in considerably smaller numbers.

[Azov (Z.).] **Азов (З.). Sédiments atmosphériques comme régulateurs des quantités de chenilles de l'*Euxoa segetum* Schiff. sur les jets du seigle d'automne dans le gouvernement du Dvina du Nord.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 569–571. Leningrad, 1929.

To determine the relation between climatic factors and the infestation of winter rye by *Euxoa segetum*, Schiff., observations were carried out in various districts of the Government of North Dvina in 1922–27. Detailed climatographs showed that the chief factor is the quantity of rainfall in May and that rain in July occasionally plays an important part in checking an infestation.

About 40 mm. [1½ ins.] of rainfall or less formed the most favourable conditions for an outbreak; the activity of the moth decreased in direct proportion to the increase in rainfall from 40 to 60 mm. [2¼ ins.] and was reduced to a minimum by a further increase up to 80 mm. [3 ins.] or more, so that finally it was hardly noticeable on sprouting winter rye. A decrease in rainfall from the optimum caused a similar reduction in activity, no infestation occurring when it was

15 mm. [about ½ in.] or less. This relation between rainfall and outbreaks may be explained by the fact that both the mature larvae in May and the young ones in July easily succumb to fungous and bacterial diseases after heavy or frequent rains. In 1926 the percentage of larvae killed was 25, and in 1927 over 37.

[Davuidov (A. I.).] **Давыдов (А. И.). Control of agricultural Pests in the Leningrad Government.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 629–644. Leningrad, 1929.

A detailed account is given of the work of the Leningrad Station for Protection of Plants during the period 1918–1927. The chief pests of field crops were *Feltia* (*Euxoa*) *exclamationis*, L., *E. segetum*, Schiff., and species of *Sitona*, *Apion* and *Phyllotreta*. Orchard pests included *Anthonomus pomorum*, L., *Psylla mali*, Schmidb., *Hyponomeuta malinellus*, Zell., and *Aphis pomi*, DeG., on apples, and *Pteronus ribesii*, Scop., and *Pristiphora pallipes*, Lep., on gooseberries. Vegetables were chiefly damaged by *Phyllotreta undulata*, Kutsch., *P. nemorum*, L., *Phaedon cochleariae*, L., *Pieris brassicae*, L., *P. rapae*, L., *Phorbia* (*Hylemyia*) *brassicae*, Bch., *P.* (*H.*) *floralis*, Fall., and *Ceuthorrhynchus quadridens*, Panz. A campaign was carried out against insects infesting stored products and *Anobium punctatum*, DeG. (*striatum*, Ol.), which was a serious pest in houses in Leningrad.

[Legatov (V. V.).] **Легатов (В. В.). Tests for the Control of *Anobium domesticum*, Fourcr.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 651–653. Leningrad, 1929.

A house in Tambov (central Russia), built of logs and neither plastered nor papered, was seriously infested with *Anobium punctatum*, DeG. (*domesticum*, Geoffr.), the lower beams, especially those in dark, damp places, being particularly damaged.

A 1·5 per cent. solution of mercury bichloride, applied four times, was sufficient to poison the wood and kill the larvae, examination of the walls four months later revealing no new exit holes. The poison was introduced through holes made in the beams 4 ins. apart and 3½–5 ins. deep at the rate of 60–75 c.c. to each hole; spring is the best time for such treatment.

[Chorbadzhiev (P.).] **Чорбаджиев (П.). Agricultural Entomology in Bulgaria and Pests of cultivated Plants in that Country.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 654–661, 56 refs. Leningrad, 1929.

The history of the study of injurious insects in Bulgaria since 1878 is briefly reviewed, and a short report is given on the work of the Entomological Section of the Central Experiment and Control Agricultural Station in Sofia. Over 550 species of insect pests have so far been recorded from various parts of the country, and a list is given of 142 that are of special importance.

Entomoscelis adonidis, Pall., is a very serious pest of rape and other crucifers, and in several localities it often destroys the whole crop. In 1927 oviposition occurred from the second half of October to about the middle of November. The eggs hatched in early spring, and the

larval stage lasted about 22 days. Pupation took place in the soil at a depth of 1–1½ ins., and the adults emerged in about three weeks, being observed on the surface in the beginning of May. At the end of this month they re-entered the soil for aestivation, which lasted the whole summer.

[Sokanovskiĭ (B.).] **Соковский (Б.). Sur la plasticité biologique des Scolytiens et les causes qui l'évoquent.** [*In Russian.*] —*Défense des Plantes*, v (1928), no. 5–6, pp. 667–668. Leningrad, 1929.

As a result of the removal of most of the spruces, which were severely damaged by fire in 1922, from a mixed forest of spruce and pine in the Bryansk Government, the typical pests of spruce, *Ips duplicatus*, Sahlb., *Polygraphus poligraphus*, L., and *I.* (*Pityogenes*) *chalcographus*, L., which occurred on isolated trees uninjured by the fire, on becoming extremely abundant in 1926, migrated to healthy standing pines and heavily infested them. New breeding conditions were thus artificially created to which these bark-beetles easily adapted themselves for several generations. In heavily infested mixed stands of spruce and pine, therefore, when a complete clearing of one of the species is effected, 5–10 per cent. of the felled trees should be left as trap logs to protect the remaining species from infestation.

[Sokanovskiĭ (B.).] **Соковский (Б.). Matériaux pour servir à l'étude de la faune des *Pityophthorus* Eich. dans le gouvernement de Brjansk.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 669–670. Leningrad, 1929.

Brief notes are given on the occurrence of *Pityophthorus micrographus*, L., *P. lichtensteini*, Ratz., *P. glabratus*, Eichh., *P. trägårdhi*, Spess., and *P. morosovi*, Spess., on various conifers in the forests of the Bryansk Government.

[Sokanovskiĭ (B.).] **Соковский (Б.). Supplement to the Fauna of the Bark-beetles of the Vladimir Government.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 670–672, 1 ref. Leningrad, 1929.

This paper is supplementary to one previously noticed [*R.A.E.* A, xvi, 543]. The bark-beetles observed in 1927 infesting spruce were *Crypturgus hispidulus*, Thoms., *Pityophthorus trägårdhi*, Spess., *P. morosovi*, Spess., and *Ips* (*Orthotomicus*) *starki*, Spess.

[Shishov (K.).] **Шишов (К.). Essai de détermination des Scolytiens d'après leur orifices d'éclosion.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 673–675. Leningrad, 1929.

A description is given of a method of using small pieces of wood with graduated points for measuring the diameter of the exit holes of various bark-beetles, the identity of which may be determined from these measurements and their numbers estimated. Experiments with these instruments, the margin of error of which is 0·1 mm., showed that the diameters of the exit holes of *Ips* (*Pityogenes*) *chalcographus*, L., *Polygraphus poligraphus*, L., *Ips duplicatus*, Sahlb., and *I. typographus*,

L., always differ slightly. The instrument is particularly useful in the determination of species if the typical characters of the galleries have been destroyed.

[Talitzkiĭ (V.).] **Талицкий (В.). *Lymantria dispar* L., as a Pest of Cereals.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 677–678. Leningrad, 1929.

In the summers of 1926 and 1927, an outbreak of *Porthetria* (*Lymantria*) *dispar*, L., occurred in a deciduous forest in the eastern part of the former Ekaterinoslav Government. After many of the trees had been defoliated, the larvae migrated to adjoining fields of winter wheat, which they severely damaged, feeding in many instances not only on the leaves but also on the stems. Trap ditches dug round the fields did not stop the migration. Larvae taken from infested fields and reared on wheat in the laboratory produced normal adults.

[Maslovskiĭ (N.).] **Масловский (Н.). *Chaetocnema concinna* Mrsh. and *Phyllotreta vittula* Redtb. causing a Mass Infestation in Transbaikalia.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 678–679, 1 ref. Leningrad, 1929.

Brief notes are given on the occurrence of *Chaetocnema concinna*, Mshm., and *Phyllotreta vittula*, Redtb., in 1926 in the Sretensk region, where these flea-beetles severely damaged large areas of summer wheat, the former infesting the stems and the latter skeletonising the leaves.

Bayer (C. G. F. H.). **Over de biologie van *Pseudococcus adonidum* (Linn.) Westw.** [On the Biology of *P. adonidum*.]—Thesis, xi+144 pp., 35 figs., 1 pl., 8 pp. refs. Leyden, R. Univ. [1929]. (With a Summary in English.)

The investigations described were made to obtain information on the manner in which the Coccid, *Pseudococcus adonidum*, L., reacts to gravity and light.

Bodenheimer (F. S.) & Guttfeld (M.). **Ueber die Möglichkeiten einer biologischen Bekämpfung von *Pseudococcus citri* Risso (Rhy. Cocc.) in Palästina.** [On the Possibilities of biological Control of *P. citri* in Palestine.]—*Z. angew. Ent.*, xv, no. 1, pp. 67–136, 24 figs., 17 refs. Berlin, May 1929.

The studies of the biological control of *Pseudococcus citri*, Risso, carried out in Palestine from 1925 to 1927, of which this is a detailed report, have already been noticed from a preliminary paper [*R.A.E.*, A, xvi, 629]. Descriptions are given of the stages of *P. citri* and its indigenous parasites, and the results of observations on the length of the various stages, the rate of oviposition as compared with temperature and with the quantity of food taken, and the number of Coccids destroyed by certain of the parasites are shown in numerous tables. The failure to establish *Cryptolaemus montrouzieri*, Muls., in Palestine is discussed and compared with the successful results obtained with it in other parts of the world, and some notes are given on the method of controlling insects by means of introduced natural enemies.

Rhumbler (L.). **Zur Begiftung des Kiefernspanners (*Bupalus piniarius* L.) in der Oberförsterei Hersfeld-Ost 1926.** [The Control of *Bupalus piniarius*, L., in the Upper Forestry Division of Hersfeld-Ost in 1926.]—*Z. angew. Ent.*, xv, no. 1, pp. 137–158, 3 figs., 6 tables, numerous refs. Berlin, May 1929.

A detailed report is given of an investigation carried out in connection with an experiment in the control of *Bupalus piniarius*, L., by dusting with calcium arsenate from aeroplanes in 1926 [*R.A.E.*, A, xvi, 494]. The results indicate that the applications of dust did not affect the progress of a natural decline in the infestation which had just set in, but that they were responsible for preventing two-thirds of the injury calculated to occur in a year of maximum feeding, and that additional factors besides Ichneumonid and Tachinid parasites are probably concerned in bringing about a natural decline in the outbreaks of this moth. Collections of excreta, taken at varying hours, showed that on an average 5 times as much was deposited during the night as during the day. The main feeding hours of the larvae, which were found to precede the main deposits of excreta by about 6 hours, apparently occur between 1 and 6 p.m. Further experiments with collecting apparatus screened from wind made at more widely varying hours might define the main feeding period more exactly. This would be of practical use in determining the hours at which dust should be distributed, so as to ensure the largest possible consumption of the insecticide before wind and rain have dispersed it.

Kleine (R.). **Der Kornkäfer im lagernden Getreide.** [The Granary Weevil in stored Grain.]—*Z. angew. Ent.*, xv, no. 1, pp. 159–164. Berlin, May 1929.

An account is given of experiments carried out to determine the comparative behaviour of the granary weevil [*Calandra granaria*, L.] in respect of wheat, barley, rye and oats, and to observe the influence exercised upon its development by light and darkness. A fixed quantity of each grain was placed in two sets of large glass containers covered with gauze, one set being exposed to the light in a room and the other left in complete darkness, after 50 weevils had been introduced into each sample. The containers were left untouched from 21st November 1927 till 21st February 1928, after which examinations were made at weekly intervals for 6 weeks, all adult weevils being removed at each examination. The total number of weevils developing respectively in rye and oats was 110 and 59 in the light and 130 and 69 in the dark. In barley 607 developed in the light and 755 in the dark, whereas in wheat only 174 developed in the light as compared with 1,409 in the dark. In view of these results, which are discussed in detail, it is suggested that attacks by *C. granaria* might be considerably reduced by suitable treatment in storage, including improved illumination and ventilation, which are considered of more value than fumigation and spraying.

v. Butovitsch (V.). **Zur Biologie der *Chimabache fagella*, F.** [On the Biology of *C. fagella*.]—*Z. angew. Ent.*, xv, no. 1, pp. 178–180. Berlin, May 1929.

The Tineid, *Chimabache fagella*, F., was found among a number of insects attacking the leaves of beech in the neighbourhood of Ebers-

walde in the autumn of 1928. The larva, which makes a shelter between two leaves spun together, feeds mainly at night on foliage in the immediate vicinity, the chief food-plant being beech, though oak and birch are also attacked. If taken from its shelter and placed on untouched foliage, the larva spins a fresh one in about 6 hours. In the laboratory the first larva pupated on 15th October and the first adult emerged three weeks later.

BÖNING (K.). **Insekten als Ueberträger von Pflanzenkrankheiten.** [Insects as Transmitters of Plant Diseases.]—*Z. angew. Ent.*, xv, no. 1, pp. 181–206, 269 refs. Berlin, May 1929.

The part played by insects in the transmission of plant diseases is discussed and illustrated from the literature. Transmission is divided into two classes, contact transmission and wound transmission. Contact transmission occurs when the activity of the insect as a transmitter is independent of its behaviour towards the plant in other respects, just as in pollination. Wound transmission is associated with injury caused by the feeding of the insect on the plant and may be either adherent or secretory. In the case of adherent wound transmission the insect soils its mouth parts by feeding on affected plants and transmits the reproductive forms of the causal agent to subsequent food-plants. Secretory wound transmission occurs when the causal agent passes into the body of the insect and is introduced into wounds with the saliva in feeding. In so far as reproduction or transformation occurs within the insect, it may be considered an intermediate host of the causal agent. This kind of transmission occurs particularly in the case of virus diseases, whereas those caused by micro-organisms are only represented by a few examples in this class.

The relationship between insects and virus diseases is also divided into two categories, in the first of which transmission is not exclusively dependent on the intervention of the insect, the chief transmitters being various species of Rhynchota. In the second, insect transmission is essential. An example of the first class is cucumber mosaic, which is generally transmitted through the agency of beetles, although various sucking insects can transmit it and it has been produced by artificial inoculation of infected sap. The second class is represented by aster yellows, curly-top of beet and streak disease of maize, transmitted respectively by *Cicadula sexnotata*, Fall., *Eutettix tenella*, Baker, and *Cicadulina* (*Balclutha*) *mbila*, Naude. It is important to notice that an uninfected insect feeding for the first time on an infected plant is not immediately capable of transmitting the disease. The incubation is only 24–48 hours in the case of curly-top and streak disease, but the virus of aster yellows must remain at least 10 days in the Jassid before it can be transmitted in a virulent form to a new host. This virulence may be lost soon after it is acquired, or may be preserved indefinitely in the host, but cannot be transmitted to its offspring. Leaf crinkle disease of beet, transmitted by *Piesma quadrata*, Fieb. [*R.A.E.*, A, xvi, 591] should perhaps be included in this class. The existence of an incubation period within the insect indicates that the causal agent of a given disease must be reanimated in the body of the transmitter. The length of the incubation period in the case of aster yellows indicates that either reproduction or transformation must take place inside the vector, and there is very little doubt that the causal agent is of a biological rather than of a chemical nature.

Blunck (H.), Bremer (H.) & Kaufmann (O.). **Untersuchungen zur Lebensgeschichte und Bekämpfung der Rübenfliege** (*Pegomyia hyoscyami* **Pz.). 9. und 10. Mitteilung.** [Investigations on the Life-history and Control of the Beet-fly. 9th and 10th Communications.]—*Arb. biol. Reichsanst.*, xvii, no. 2, pp. 103–224, 15 figs., 150 refs. Berlin, May 1929.

These two papers are the continuation of a series of reports on studies of *Pegomyia hyoscyami*, Panz., carried out over a number of years [*R.A.E.*, A, xvii, 250].

Bremer, in the ninth communication, presents an epidemiological analysis of beet-fly attacks. Crop reductions are estimated at 10–20 per cent., and even 30 per cent. in epidemic years, and the theoretical reproduction coefficient is calculated to be 25 to the generation and 25^3 in a year, so that the loss necessary to keep the numbers at an even level is 96 per cent. of the offspring of a generation An analysis of the fluctuations of infestation indicates that the most important restricting factors are summer temperature in its indirect effect on the development of parasites and summer rainfall when it is definitely in excess of the normal. Heavy rain washes away the eggs, kills the pupae and is said to occasion the laying of infertile eggs. In central and northern Europe low summer temperatures prevent the coincident occurrence of the generations of parasites and host. The more important parasites of *P. hyoscyami* include *Phygadeuon pegomyiae*, Haberm., and *Opius fulvicollis*, Thoms., the rate of the development of both of which is more susceptible to variations of temperature than that of the host, *O. nitidulator*, Nees, *Trichogramma evanescens*, Westw., *Aleochara bipustulata*, L., and *A. bilineata*, Gyll. An attempt is made to express numerically the destructive value of the individual ecological restricting factors in representative cases. Mortality in the early larval stages is high, but apart from this, the chief constant factors affecting development are the time of appearance and number of parasites and the contemporary existence of corresponding numbers of both sexes and of opportunities for mating and the consequent production of viable eggs. Occasional factors include isolated climatic abnormalities and the attacks of predators. The more completely the individuals of one stage of development are parasitised from a definite date onwards, the sharper will be the time distinction between the generations. Local variations of infestation are analysed, wind being one of the principal factors concerned in the distribution of ovipositing females.

The area of distribution of *P. hyoscyami* is discussed, and the relationship between the history of its appearance in the various beet-growing regions of the world and the weather conditions prevailing in these regions is indicated in tables. The annual isotherms of these regions lie somewhere between —2 and +20° C. [28·4 and 68° F.]. Within this whole area, the annual isotherms of the area of mass distribution lie between 0 and 13° C. [32 and 55·4° F.], or within the lower half of the total range of temperature conditional to life. Within this area again, the area of permanent injury, which corresponds approximately with the northern range of sugar-beet cultivation in Europe, is characterised, the annual isotherms lying between 7 and 9° C. [44·6 and 48·2° F.]. The isotherms of the summer months in this area are as follows: 14·5–17° C. [57·2–62·6° F.] in June; 16·5-18·5° C. [61·7–65·3° F.] in July; 15·5–17·5° C. [59·9–63·5° F.] in August. In

regions of beet cultivation where the summer is cool, all generations of *P. hyoscyami* occur in the largest possible numbers, whereas in regions where the summer is hot, the first generation is generally the only one of importance. An attempt is made to classify the conditions necessary to the outbreak of an epidemic. In a mild (Atlantic) climate the fly tends to appear before the beet in the spring, and the more extreme (continental) the climate the longer after the plants it appears. The region most seriously threatened by beet-fly epidemics is one in which the climate will admit of the development of several generations of the fly and where at the same time the cool summer exercises a greater restriction over the development of the parasites than over that of the host. The heaviest attacks seem likely to occur in regions where the July isotherm lies between 16·5 and 18·5° C. [61·7–65·3° F.], where the climate is not definitely Atlantic and where beet is cultivated on a large scale.

A distinction is drawn between the conditions governing a general tendency to epidemics, which are limited to the area of permanent injury, and those conducing to the development of individual local epidemics, which may occur at any point within the area of mass distribution. Epidemics can develop in small local foci. An extension of the area of the epidemic often follows the attainment of its greatest intensity. The waning of the epidemic may be protracted and interrupted by frequent renewals of the outbreak, and many isolated intensive foci may be left after it has died down. The outbreak of an individual epidemic is dependent upon climatic conditions in spring, abnormal damp being an adverse factor. A low summer temperature, which checks the development of parasites, is essential to the further development of the epidemic, the decline of which is brought about by heavy rain or a sudden rise in temperature. The decline of an epidemic can be predicted when parasitism amounts to 80–90 per cent.

In the tenth communication Kaufmann continues the review of infestation in Silesia [*loc. cit.*]. A fresh field of observations was opened up by the movement of the Biologische Reichsanstalt to Heinrichau in the spring of 1928, and the long summer drought of that year provided a new set of conditions for the study of *P. hyoscyami* and its parasites. The investigation of the possibilities of forecasting attacks was of particular interest. The waste water from 12 sugar factories was examined and most of the 100,000 pupae taken were bred out. Parasitism varied between 33 and 98 per cent. The parasites, of which the most numerous was *Phygadeuon pegomyiae*, included: *Opius spinaciae*, Thoms., *O. fulvicollis*, *O. ruficeps*, Wesm., and *O. bremeri*, Bengtsson. *O. nitidulator* and *O. carbonarius*, Nees, were entirely absent.

Other food-plants of *P. hyoscyami* included spinach, mangels, red beet, *Atriplex*, *Chenopodium*, *Amarantus blitus*, and some solanaceous plants.

Bestrijding van ziekten en plagen. [Measures against Diseases and Pests.]—*18. Jaarversl. Kol. Inst., Amsterdam 1928*, pp. 32–34. Amsterdam [1929].

A section in this report deals with some well-known insects found in tropical products. Dried bananas imported from Java were infested by a Bostrychid (probably *Dinoderus minutus*, F.), *Laemophloeus* spp., *Cathartus advena*, Wlt., *Silvanus surinamensis*, L., *Necrobia rufipes*, DeG., and *Carpophilus* sp.

Mercet (R. G.). **Notas sobre Afelinidos (Hym. Chalc.). 2a nota.**—*Eos*, v, no. 1, pp. 111–117, 6 figs. Madrid, 20th May 1929.

The first part of this list has been noticed [*R.A.E.*, A, ix, 368]. The species here dealt with are *Marietta marchali*, sp. n., from Coccids on *Mimosa* in Madagascar; *Cales noacki*, How., from *Orthezia* sp. in Brazil; and *C. pallidus*, Brèthes, from *Aulacaspis* (*Diaspis*) *pentagona*, Targ., in Argentina and *Aleurothrixus porteri*, Quaint., in Chile.

Candura (G. S.). **Gl'insetti del frumento nel granaio.** [Wheat Insects in the Granary.]—*Circ. R. Lab. Ent. agrar. Portici*, no. 5, 34 pp., 15 figs. Portici, 1929.

The chief pests of stored wheat in Italy are *Sitotroga cerealella*, Ol. [*R.A.E.*, A, xv, 164], *Plodia interpunctella*, Hb., *Calandra granaria*, L., and *Tenebroides mauritanicus*, L. The adults of *P. interpunctella* usually appear early in June. There are 3 generations a year in hard grain and 4 in soft, but as they overlap, adults may be found throughout the year. The larval stage predominates in winter. The Ichneumonid, *Nemeritis canescens*, Grav., parasitises the larvae.

Calandra granaria hibernates as an adult or sometimes as a larva; mating occurs in spring, usually in April, and the adults of the second generation appear at the end of May or early in June. There are 3–5 generations a year in southern Italy. Larvae and adults carried to the fields with seed can hibernate underground at a depth of 8 inches, and the adults can then oviposit in the grain in summer. The Chalcid, *Lariophagus distinguendus*, Först., is a larval parasite that is common in Italy.

The adults of *Tenebroides mauritanicus* emerge from spring to autumn. The females that appear at the end of summer or in autumn generally only oviposit after hibernation. Usually there is one generation in the year. Adults and larvae of all sizes occur in winter.

Of less importance than the foregoing are *Calandra oryzae*, L., *Ephestia kühniella*, Zell., *Silvanus surinamensis*, L., *Tribolium confusum*, Duv., and *Sitodrepa panicea*, L.

The usual preventive and remedial measures are described. There are no legislative enactments concerning stored grain in Italy, and imported grain is not subject to examination.

Tattersfield (F.) & Hobson (R. P.). **Pyrethrin I and II. Their Estimation in Pyrethrum** (*Chrysanthemum cinerariaefolium*). **II.**—*J. Agric. Sci.*, xix, pt. 3, pp. 433–437, 6 refs. Cambridge, July 1929.

As different conclusions have been reached by workers in Japan and Switzerland as to the nature of the active principles in pyrethrum, and as the suggestion has been made that different poisons may be produced by the same plant in Japan and Europe, the contents of pyrethrin I and II in samples grown from both Swiss and Japanese seed were determined by the acid method described in a paper already noticed [*R.A.E.*, A, xvii, 407] in order to test the validity of this analytical process for both varieties of pyrethrum. The results show that the method is as suitable for testing flowers from Japanese seed as from Swiss seed, and it seems almost certain that the poisons are identical in the two cases.

The acid method of analysis takes several days to complete, and the operations required are rather numerous, and as pyrethrin I has been shown to be the more important poison of the two [*loc. cit.*], a more expeditious means for its determination was devised. A comparison of the data obtained by this method with those obtained by the longer process, shows a close agreement between the figures. Thus this method, which is described in detail, gives results sufficiently accurate for most purposes, and at the same time can be carried out in a few hours and on a small amount of material.

Pelaghias (C. G.). **Investigations into the Locust Plague in Cyprus.**—*Cyprus Agric. J.*, xxiv, pts. 1–2, pp. 10–20, 54–62, 2 tables. Nicosia, January & April 1929.

A brief survey of the history of locust invasions in Cyprus is given. Extensive campaigns by means of screens and traps have been organised by the British Government since 1879, and in 1884 locusts were reduced to more or less manageable numbers. Since then the breeding areas of the locust (*Dociostaurus maroccanus*, Thnbg.) are carefully surveyed each year, and control measures are applied. These consist partly of spraying with arsenicals, but mainly of the purchase by the Government of locusts collected by means of large net-shaped bags, with which the ground is swept. Locust centres are established in the more important areas, and the locusts are paid for by weight, the rates of payment being fixed from time to time by the Government, according to the abundance or scarcity of locusts and current labour rates. Each day's purchase is destroyed with lime in pits.

Apart from the ordinary locusts, various grasshoppers are considered to be injurious to some extent, and they are also purchased at the locust centres; the author, however, considers that this policy should be abandoned.

A full list of breeding grounds of *D. maroccanus* is appended.

Since the British occupation, the island has been visited once, in 1915, by swarms of *Schistocerca gregaria*, Forsk.

Mitra (S. K.) & Khongwir (P. C.). **Orange Cultivation in Assam.**—*Bull. Dept. Agric. Assam*, no. 2 of 1928, 19 pp. [Shillong] 1928.

Very little attention has been given to the many insect pests attacking oranges in Assam. Among the more important is *Papilio demoleus*, L. (lemon caterpillar), which devours the leaves of the trees and against which hand-picking and spraying with lead arsenate are recommended. As a remedy for the borer, *Monochamus* (*Monohammus*) *versteegi*, Rits., the trunks should be whitewashed for about 3 ft. upwards from the ground and banded with straw or cotton to prevent the beetles climbing the trees; clean cultivation is also recommended. The leaf-miner, *Phyllocnistis citrella*, Stn., does a good deal of damage to young trees; the remedies are hand-picking and, in the case of severe infestation, spraying with a mixture of crude oil emulsion and tobacco decoction. Coccid pests include *Pseudococcus citri*, Risso, and *Saissetia oleae*, Bern. (black scale), both of which may be controlled by kerosene emulsion. *Rhynchocoris humeralis*, Thunb. (green orange bug) sucks the juices of the fruit and probably causes the premature dropping that often occurs in June and July.

Bolle (P. C.) & Stammeshaus (L.). **Onderzoekingen over de biologie en de bestrijding van de walang kongkang.** [Investigations on the Biology and Control of *Phaenacantha saccharicida*.]—*Arch. Suikerind. Ned.-Indië*, 1929, pp. 459–504, 6 figs., 1 pl., 5 refs. (*Meded. Proefst. Java-Suikerind.*, 1929, no. 7.) Soerabaya, 1929. (With a Summary in English.)

The Lygaeid, *Phaenacantha* (*Colobathristes*) *saccharicida*, Karsch, all stages of which are described, has long been known as an occasional pest of sugar-cane in Java, but since 1926 it has been present in the cane fields in the west of the Island and has been multiplying enormously. The eggs hatch in 8–14 days, and the adult stage is reached 29–34 days later, after which the bugs may live at least 6½ months. The eggs are laid in damp sheltered places on the ground, on the cane leaves or inside the leaf sheaths. Females laid an average of one a day during the 2½ months they were observed ; in the dry season (May to August) very few eggs are laid, so that not more than 4–5 generations occur annually. Both nymphs and adults usually feed on the lower surface of the leaves ; yellowing of the leaves and stunting of the cane result from the attack, and this probably delays ripening. After the old cane is cut, the bugs migrate to new fields. On hot and especially on windy days they seek shelter in cracks in the ground or between lumps of earth at the base of the cane stool. When such places are not available, as in newly planted fields, they migrate to neighbouring weeds, leaving them at night to feed on the cane.

Fowls feed readily on the bugs. An unidentified parasite, probably an Encyrtid, was reared from the eggs and has also been found by Van der Goot in the eggs of *Leptocorisa acuta*, Thnb., and *Nezara viridula*, L. Details of its morphology and biology are given. It multiplies more rapidly than *P. saccharicida*, but is handicapped by the migration of the latter to new fields and by the scarcity of its eggs in the dry season. As a result of experiments, the following combination of measures is recommended. Leaves should be burnt immediately after harvesting. Weeds near the fields should be burnt or treated with a spray of tobacco and soap or calcium cyanide dust. These insecticides may also be used on young cane and against bugs hiding on the ground. The bugs may also be caught with nets, or torches may be used at night, the bugs flying into the flame when the plants are shaken. Heaps of cane leaves may be used as traps.

Tabe (C.) & Mishima (R.). **Studies concerning the Aphid, *Cinacium iwakusuiensis*, Kishida (Phylloxeridae).** [*In Japanese.*]—*Nogaku Kenkyu*, xiii, pp. 255–289, 2 pls. Kurashiki, 1929.

Cinacium iwakusuiensis, Kishida [which is apparently the Aphid previously recorded as *C. iaksuiense* (*R.A.E.*, A, xiii, 140)] is very injurious to pear in the Nara prefecture, where it was first noticed in 1912, but has not been found elsewhere except in Korea. It attacks the fruit, branches and stems. There are 6–10 generations a year, hibernation taking place in the egg stage in a crevice on the bark or on the lower part of the bud. The eggs hatch in April and May, and parthenogenetic reproduction continues throughout the summer. The eggs hatch in 5–16 days, and the Aphids are mature 6–25 days later, depositing 40–100 eggs during an adult life of 10–30 days. The sexuparae appear from September onwards, each laying an average of 17·8 female

and 9·7 male eggs. The sexual forms occur from September to November ; only a single egg is deposited by each female. No winged form of this Aphid has been found. Lime-sulphur is considered a very effective spray for it.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Ann. Rep. Guam Agric. Expt. Sta. 1927*, pp. 12–17. Washington, D.C., January 1929.

Owing to the manner of growth of palm trees, liquids are caught and held for a time in and around the leaf bases, percolating slowly through the fabric-like outgrowths that flank the base of each leaf, and preliminary work with sea water applied partly as a drench and partly as a spray has shown it to be very effective against *Pseudococcus cocotis*, Mask., *Lepidosaphes mcgregori*, Banks, and *Pinnaspis* (*Hemichionaspis*) *minor*, Mask., which often congregate in such numbers on the tender white tissues in these places and in the folds of the young unopened leaves as seriously to damage or even kill the tree.

In the case of an African oil palm [*Elaeis guineënsis*] which was so badly infested with *P. cocotis* that the crown shoot was dead and decaying at the base, three applications, each of 5 U.S. gals. sea water, half as a drench and half as a spray, at intervals of about 10 days, were sufficient to rid the palm of mealybugs, arrest the progress of decay, and enable the tree to resume its normal rate of growth.

A shipment of *Comperiella bifasciata*, How., attacking the Florida red scale [*Chrysomphalus ficus*, Ashm.] was received from California for trial on *Aspidiotus destructor*, Sign. A total of 70 parasites was obtained, of which approximately one-third was liberated and the remainder tried without success under insectary conditions. *C. bifasciata* seems too large an insect to parasitise successfully the comparatively small and very flat *Aspidiotus*. Those liberated in the field may possibly become established on *Lepidosaphes mcgregori*, which is a larger scale often found on coconuts in association with *A. destructor*. A second attempt [*cf. R.A.E.*, A, xvii, 48] was made to establish *Lindorus lopanthae*, Blaisd., on *A. destructor*, 22 beetles being liberated. An attempt was also made to send a colony of *Cryptogonus orbiculus* var. *nigripennis*, Wse., which has proved very effective against *A. destructor* in Guam, to the Fiji Islands, where this scale is on the increase.

Pyrausta nubilalis, Hb. (European corn borer), although present throughout the Island, did perceptibly less damage than usual to the two main crops of maize, which was due in the first case to conditions unfavourable for the increase of the borer, and in the second to the extremely quick growth to maturity made by the maize. Dry weather checks the growth of the maize plants and enables two or three generations of the borer to develop, so that the crop is practically ruined. When there is sufficient rain to ensure the rapid growth of the maize, only one generation of *P. nubilalis* develops, and that does very little damage. For this reason the borer is not so serious a pest in the southern part of the Island, which has a more equable rainfall, as in the central maize-growing region, which has periods of little or no rain.

The crop of taro [*Colocasia esculenta*] was attacked by *Prodenia litura*, F. (Egyptian cotton worm), a pest that appears to be so firmly established in Guam that it is impossible to eradicate it. An attempt was made to breed this moth on edible canna [*Canna edulis*], but only the larger larvae were induced to feed, and as taro is also subject

to the attacks of a leafhopper, *Megamelus* sp., and a fungus, *Gloeosporium* sp. (which is incidental to the leafhopper injury and often destroys the crop), edible canna, which seems to be free from these and other pests, is strongly recommended as a substitute.

Chrysomelids, which were first noticed two years ago attacking an oxalidaceous tree, are spreading and have done considerable damage to mango and rose-apple [*Eugenia*]. The beetles eat the tender bark of the new shoots as well as the leaves and thus destroy the plant. Although spraying with a weak arsenical was found to control them, their spread is regarded with apprehension owing to the impracticability of extensive spraying operations.

Leptoglossus sp., attacking cucurbits in the southern part of the Island, was successfully controlled by spraying with a solution made by macerating and steeping 4 lb. tobacco refuse in 1 U.S. gal. water. The spray killed the eggs and nymphs and seemed to be repellent to the adults.

Citrus is damaged by a Tineid that makes shallow mines beneath the epidermis on both sides of the leaf. Mature trees are only slightly injured, but the growth of young seedlings is seriously retarded. The life-cycle lasts 12–25 days, and many generations may overlap during the year.

A species of *Asterolecanium* found attacking the only two specimens of *Flacourtia ramontii* on the Island was effectively controlled with kerosene emulsion. No other food-plant was discovered except a cover crop of *Tephrosia* sp. planted from seed around the trees. The scale is parasitised by a Chalcid. An entomogenous fungus was discovered attacking *Chrysomphalus aurantii*, Mask. (red scale) and promises to be of value in suppressing any possible spread of it, as it was successfully established at places where it had not been previously observed.

JACK (R. W.). **Report of the Chief Entomologist for the Year 1928.**— *Rep. Secy. Dept. Agric. S. Rhodesia, 1928*, pp. 39–46. Salisbury, 1929.

Many of the pests reported during 1928 are the same as those recorded in previous years [*R.A.E.*, A, xv, 638; xvi, 648]. In tobacco seed beds much loss has been caused by the seeds being carried off by various ants. Calcium cyanide powder was found to be effective in preventing this. The white grub, *Anomala exitialis*, Pér., was also destructive to tobacco. On maize, *Heteronychus licas*, Klug (black maize beetle) was troublesome, and much damage was done by *Busseola* (*Glottula*) *fusca*, Fuller (maize stalk borer). Trap crops were planted for the latter and became infested, but their value is not yet known. Burial of infested maize stalks in loose soil at various depths was a successful measure; when buried below two inches, no moths reached the surface. Full-grown borers removed from maize stalks did not attempt to form any protection for themselves, beyond trying to bore into anything available, and failing this, all perished. Top dressing with proprietary insecticides and with derris powder resulted in satisfactory mortality, but all except the derris scorched the plants. A Braconid, probably *Microbracon* (*Bracon*) *sesamiae*, Cam., parasitised about 40 per cent. of the over-wintering borers in an open insectary. Over 95 per cent. of the weevils, *Tanymecus destructor*, Mshll., present in a maize field were killed by one application of a poison bait consisting of 1 lb. sodium arsenite, 8 lb. sugar and 10 gals. water on chopped fodder. Against the adults of

Calandra oryzae, L., in an infested granary, a petroleum spray diluted to 1 : 30 proved effective. Ground-nuts in the Salisbury district were practically destroyed by white grubs, *Eulepida mashona*, Pér., which also attacked maize. Deciduous fruits were considerably damaged by Cetoniids, chiefly *Pachnoda impressa*, Goldf., and *P. rufa*, DeG. The Tettigoniid, *Maxentius pinguis*, Wlk., which was present in numbers and attacked young *Eucalyptus*, was successfully poisoned by dipping weeds in 1 lb. sodium arsenite, 2 gals. molasses and 10 gals. water and distributing the bait about infested ground. Against the cutworm, *Euxoa segetum*, Schiff., poison baits tested included 1 lb. sodium arsenite in 20 gals. water, 1 lb. Paris green in 5 gals. water, and 1 lb. sodium fluoride in 5 gals. water. Paris green was the most successful and sodium arsenite came second. The arsenicals were used on chopped sow thistle (*Sonchus oleraceus*), spineless cactus and other green stuff. The sodium fluoride was used on chopped spineless cactus, and the result may have been affected by the slower action of the sodium fluoride. The baits were successful on bare ground but not among infested potatoes. Wireworms [Tenebrionids] of the genus *Trachynotus* were injurious to tobacco, cotton and maize. Effective baits used against the adults on cotton consisted of 1 lb. Paris green in 180 lb. maize meal, mixed dry and moistened to a friable mash, and 1 lb. sodium arsenite dissolved in 20 gals. water mixed with maize meal into a friable mash. These were covered over with foliage or other available material. On tobacco the beetles were active during late April or early May. During a heavy outbreak of *Phthorimaea operculella*, Zell., on tobacco in February, two parasites were reared, one an Ichneumonid and the other a Braconid, the percentage of parasitism with the former being as high as 50 per cent. This is the first record of parasites of this moth in Southern Rhodesia.

[Tooke (F. G. C.).] **The Eucalyptus Snout-beetle Situation.**—*Fmg. S. Afr.*, reprint no. 43, 1 p. Pretoria, June 1929.

The distribution of the Mymarid egg parasite of the eucalyptus snout-beetle [*Gonipterus scutellatus*, Gyll.] has been continued during the season [*R.A.E.*, A, xvi, 648] as the only measure against that pest. In all, about 100,000 parasites have been liberated in the Transvaal, Natal, East Griqualand and Transkei. In the south-western Cape areas, the parasite is so strongly established that no further distributions are required ; it is already present in every plantation of *Eucalyptus*. In Natal, since the parasite was first liberated two years ago, the improvement is so marked that the weevil has been reduced to almost negligible numbers. In the Eastern Cape Province, the Mymarid is spreading very rapidly, too rapidly for any appreciable check on the weevil to be noticeable as yet. In the Transvaal high veldt, climatic conditions are very unfavourable to the parasite, and though it has survived several severe winters, the prolonged dry season, the absence of new growth on the trees and the scarcity of the host egg-masses have prevented its maintaining effective strength in the early part of the season. In this area, therefore, supplementary measures should be practised, especially autumn and winter cultivation in the plantations, thus exposing larvae and pupae of *Gonipterus* in the soil, and stimulation of growth in early spring.

Britton (W. E.). **Twenty-eighth Report of the State Entomologist of Connecticut, 1928.**— *Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 666–768, 16 pls. New Haven, Conn., April 1929.

Notes are given on the insects occurring in Connecticut during 1928. The species not recorded in recent reports [*R.A.E.*, A, xvi, 553, etc.] nor dealt with in special papers [xvii, 609, etc.] include: *Triaspis curculionis*, Fitch, which parasitised an average of 5 per cent. of the larvae of *Conotrachelus nenuphar*, Hbst.; *Phobetron pithecium*, S. & A. (hag moth) on apples and pears; *Lagoa crispata*, Pack. (crinkled flannel moth) on raspberries; *Contarinia pyrivora*, Riley, on pears; *Ceuthorrhynchus rapae*, Gyll., in the stems of cabbage plants; *Cimbex americana*, Leach (elm sawfly); *Halisidota tessellaris*, S. & A. (tessellated tussock moth) on sugar maple [*Acer saccharum*]; *Haltica ulmi*, Woods (green elm leaf-beetle); *Dichelonyx elongata*, F., on oak; *Argyresthia thuiella*, Pack. (arbor-vitae leaf-miner); *Chionaspis americana*, Johnson, on elm; *Pissodes approximatus*, Hopkins, apparently causing the death of red pines in one locality; *Phloeosinus dentatus*, Say, in red cedar and arbor-vitae [*Thuja occidentalis*]; *Scolytus quadrispinosus*, Say (hickory bark-beetle); *Cyllene caryae*, Gah. (hickory borer); *Rhyacionia* (*Evetria*) *comstockiana*, Fern., on pine; the Noctuid, *Epizeuxis aemula*, Hb., injuring blue spruce [*Picea pungens*]; *Tortrix* (*Archips*) *rosaceana*, Harris (oblique-banded leaf-roller) damaging roses; *Alypia octomaculata*, F. (eight-spotted forester) defoliating grape-vines and Virginia creeper; *Aegeria* (*Sesia*) *rhododendri*, Beut. (rhododendron borer); *Eriococcus azaleae*, Comst., on azalea and rhododendron; *Rhynchites bicolor*, F., which was unusually abundant on roses; and *Agrotis ipsilon*, Hufn. (*ypsilon*, Rott.), feeding on the grass of golf links.

Injury by *Psila rosae*, F. (carrot rust fly) is becoming more prevalent on carrots and parsnips. *Rhyacionia buoliana*, Schiff. (European pine shoot moth) is increasing in abundance on pines in various part of the State.

A section of this report contains miscellaneous notes on insects by various authors including the following: a record by W. E. Britton of *Pomphopaea sayi*, F., which is rather uncommon in Connecticut, injuring peach foliage; a note by the same author on the abundance of *Tetraleurodes mori*, Quaint. (mulberry whitefly) on native and introduced trees and shrubs; a record by B. H. Walden of *Thrips tabaci*, Lind., attacking cauliflower in Connecticut for the first time; and a report by P. Garman of *Tarsonemus latus*, Banks, which is apparently new to the district, causing damage similar to that of *T. pallidus*, Banks, to greenhouse plants, particularly tomatos and tobacco, during October 1928.

Papers noticed by Title only.

Headlee (T. J.). **Administrative Phases of Teaching, Research, Regulatory and Extension Entomology.**— *J. Econ. Ent.*, xxii, no. 3, pp. 551–553. Geneva, N.Y., June 1929.

Safro (V. I.). **Extension Entomology in Relation to Research.**— *J. Econ. Ent.*, xxii, no. 3, pp. 553–556. Geneva, N.Y., June 1929.

Lengerken (H. v.). **Die Blattschnittmethode des Ahornblattrollers** (*Deporaus tristis* **F.). [Coleopt.** The Leaf-cutting Method of the Maple Leaf-roller (*Rhynchites tristis*).]—*Biol. Zbl.*, xlix, no. 8, pp. 469–490, 9 figs., 15 refs. Leipzig, 1929.

Acqua (C.). **Les maladies du ver à soie** [*Bombyx mori*, L.] **(grasserie et dysenteries) per A. Paillot e i nostri studi sullo stesso argomento.**—*Boll. R. Staz. sperim. Gelsic. Bachic.*, viii, nos. 1–2, pp. 1–30, 35–59, 1 diagr., 7 refs. Ascoli Piceno, February & April 1929.

Acqua (C.). **Les maladies du ver à soie (grasserie et dysenteries) par A. Paillot et nos études sur le même sujet.**—Med. 8vo, 70 pp., 1 graph, 1 diagr., 7 refs. Ascoli Piceno, Giuseppe Cesari [1929]. [French translation of the preceding with two appendices.]

[Il'inskiĭ (A.).] **Ильинский (А.). Les régularités dans la propagation du** [*Myelophilus*] *Blastophagus minor* **Hartig, et la base théorique de la lutte contre cet insecte aux forêts.** [*In Russian.*]—*Défense des Plantes*, v (1928), no. 5–6, pp. 523–542, 3 graphs., 3 refs. Leningrad, 1929. [See *R.A.E.*, A, xvii, 145.]

Gowdey (C. C.). **Catalogus insectorum jamaicensis. Pt. 3** [including in an appendix : **New Species of Jamaican Buprestidae and Cerambycidae,** by W. S. Fisher ; **The Crane-flies of Jamaica,** by C. P. Alexander ; **Records and Descriptions of Diptera, mostly from Jamaica,** by C. H. Curran].—*Ent. Bull. Dept. Sci. & Agric. Jamaica*, no. 4, 45+3 pp., 2 figs. Kingston, Jamaica, 1928. [*Cf. R.A.E.*, A, xv, 52.]

Wilkinson (D. S.). **A Revision of the Indo-Australian and Ethiopian Species of the Genus** *Microgaster* **(Hym. Bracon.).**—*Trans. Ent. Soc. Lond.*, lxxvii, pt. 1, pp. 99–123, 7 figs. London, 31st July 1929.

Hensch (A.). **Beitrag zur Kenntnis der jugoslawischen Ichneumonidenfauna.**—*Konowia*, vii, no. 2, pp. 99–112 ; viii, no. 2, pp. 123–153. Vienna, September 1928 & June 1929.

Mercet (R. G.). **Los géneros de Afelínidos de la fauna europea.** [A Key to the European Genera of Aphelinidae.]—*Rev. Fitopat.*, iv–vi (1926–1928), pp. 6–9. Madrid, 1929. [A dichotomic Key.]

Krishnamurti (B.). **The suctorial Apparatus of Cicada** [*Platypleura octoguttata*].—*Half-Yrly. J. Mysore Univ.*, iii, no. 1, pp. 1–44, 17 figs., 10 refs. Bangalore, January 1929.

[Mordvilko (A.).] **Мордвилко (А.). Anolocyclic Elm Aphids, Eriosomea, and the Distribution of Elms during the Tertiary and Glacial Periods.** [*In English.*]—*C.R. Acad. Sci. U.R.S.S.*, 1929, no. 8, pp. 197–202, 9 refs. Leningrad, 1929.

Takahashi (R.). **Notes on some Formosan Aphididae (2)** [including one new Genus and 3 new Species].—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 102, pp. 247–259, 14 figs. Taihoku, Formosa, June 1929. [*Cf. R.A.E.*, A, xvii, 304.]

Sakai (K.). **A List of Coccidae in Kagoshima with their Food-plants.** [*In Japanese.*]—*Kontyû*, iii, no. 2, pp. 121–130. Tokyo, July 1929.

Laing (F.) & Cockerell (T. D. A.). **A new Diaspine Coccid from South Africa.**—*Amer. Mus. Nov.*, no. 366, 2 pp., 1 fig. New York, N.Y., 31st July 1929.

Pinto da Fonseca (J.). **Um novo genero de Coccideo Lecaniinae (Hemipt.).** [*Pendularia pendens* gen. et sp. n. on *Eugenia jaboticaba* in Brazil.]—*Rev. Mus. paul.*, xvi, pp. 847–853, 2 pls., 5 refs. São Paulo, 1929.

Cockerell (T. D. A.). **The type of Genus** *Coccus* **(Homoptera, Coccidae).**—*Science*, lxx, no. 1806, p. 150. New York, N.Y., 9th August 1929.

BRITTON (W. E.) & ZAPPE (M. P.). **Inspection of Imported Nursery Stock.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 701–703. New Haven, Conn., April 1929.

The pests intercepted on imported nursery stock included : *Acronycta auricoma*, Schiff., on quince, pear, plum, apple and cherry, *Aporia crataegi*, L., *Paratetranychus pilosus*, C. & F., woolly aphis [*Eriosoma lanigerum*, Hausm.] and *Notolophus antiquus*, L., on apple, *Polia suasa*, Schiff. (*Mamestra dissimilis*, Kn.), on rose, and *Papilio podalirius*, L., on cherry, all from France ; and *Emphytus cinctus*, L., on rose from Holland, France and England.

BRITTON (W. E.) & ASHWORTH (J. T.). **Gipsy Moth Work in Connecticut in 1928.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 712–727, 1 map. New Haven, Conn., April 1929.

An account is given of the campaign against the gipsy moth [*Porthetria dispar*, L.] in 1928, which was carried out on the same lines as in previous years [*R.A.E.*, A, xvi, 553]. *Anastatus bifasciatus*, Boy., was the only parasite liberated during the year. In 1924 parasites appeared to have caused an actual reduction of the moths, but in 1925 they were much less abundant and the moths became more prevalent. In 1924, about 825 acres were defoliated in Massachusetts, this being considered the minimum for 20 years, but in 1928 there occurred the most severe infestation in recent years, approximately 262,000 acres in Massachusetts, Maine and New Hampshire being defoliated.

ZAPPE (M. P.). **Notes on Fruit Insects in 1928.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 728–729. New Haven, Conn., April 1929.

Notes are given on various insect pests of fruit trees in Connecticut in 1928. In apple orchards adjacent to peach orchards the greatest damage by *Conotrachelus nenuphar*, Hbst., always occurs nearest the peach orchard, many weevils that emerge from early dropped peaches migrating into the apple orchard. Wild apple trees that are never sprayed are also a source of infestation. Several vineyards in one locality were severely injured by *Haltica chalybea*, Ill. (grape-vine flea-beetle), the adult beetles eating the swelling buds in early spring and thus destroying the embryonic fruit clusters. When the leaves appear, both the adults and larvae feed on them. *H. chalybea* also feeds on wild grapes and Virginia creeper. The control measures advocated are the hand-picking of early adults or spraying with 2 lb. lead arsenate to 50 U.S. gals. water when the beetles first appear, and again when the leaves are out, to kill the young larvae.

GARMAN (P.). **Plant Bug Injury to Fruits.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 729–731, 1 pl., 2 figs., 7 refs. New Haven, Conn., April 1929.

During June 1928, 100 per cent. of the peaches on several trees were severely damaged by punctures causing small sunken areas from which gum exuded that resulted in the peaches dropping from the trees or

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being so deformed as to be worthless. The injury was found to be due to the Capsids, *Lygus quercalbae*, Knight, and *L. omnivagus*, Knight, which had migrated from oak trees not more than 50 yards away. Dusting with nicotine caused the bugs to drop from the trees, although they were not all killed. Numerous applications would probably have to be made to keep the trees free from the bugs at the time they are migrating. It has been found [*R.A.E.*, A, xv, 31] that there is little danger when the trees are planted a hundred yards or more from oaks, and this should be considered in laying out new peach orchards, or when the removal or treatment of neighbouring oaks is thought expedient.

GARMAN (P.). **The Oriental Peach Moth.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 731–734, 2 figs. New Haven, Conn., April 1929.

Cydia (*Grapholitha*) *molesta*, Busck (Oriental peach moth) was active in Connecticut during 1928, becoming very destructive in some orchards from which little damage had previously been recorded. In a few orchards it had decreased in abundance, probably owing to the continued action of parasites and to certain orchard practices. A map shows the distribution and abundance of the moth. The greatest damage was done in the south central district, in some instances 50–100 per cent. of the fruit being injured. Infestation of quinces was particu larly severe; this fruit appears to be particularly attractive to the moth, as over 600 larvae were obtained from a single bushel of discarded fruit, and it was estimated from the number of exit holes that fully 1,000 were originally present.

During 1928 tests were begun with ovicides and repellents, and it was found that 1 per cent. white oil emulsions combined with various contact poisons were more effective than nicotine-soap combinations. A combination of white oil emulsion and pyrethrum soap was the most successful, and it was noticed that many of the young larvae that walked over the material were killed. The results of several years' tests indicate that lead arsenate, fluosilicates and some of the fluorides are effective against recently hatched larvae.

With regard to natural control, it was found that in general those orchards most heavily infested had fewer parasites. Very few parasites of the second brood larvae infesting twigs were observed. The most important parasite during the year was *Glypta rufiscutellaris*, Cress., which began to emerge on 29th August and continued to do so until 18th October. *Trichogramma minutum*, Riley, which was first observed parasitising the eggs of *Pteronus* (*Pteronidea*) *ribesii*, Scop., on 4th June, was obtained in field cages from the eggs of *C. molesta* from 26th July until 24th September, though the individuals that emerged on the latter date did not hibernate.

ZAPPE (M. P.). **Corn Borer Clean-up Operations on the 1927 Infestations.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 734–737, 2 pls. New Haven, Conn., April 1929.

An account is given of the work of cleaning up the infestations of the European corn borer [*Pyrausta nubilalis*, Hb.] found in Connecticut during 1927. Scouting in 1928 showed that there was a marked spread westward of the double-brooded strain from Rhode Island into Con-

necticut, although the general spread westward in Massachusetts and New Hampshire was slight. The eastward spread of the single-brooded strain in New York, western Massachusetts and Vermont was quite general and in some cases covered as much as 40 miles. One locality in Connecticut was found to be infested with the single-brooded strain that had apparently come into the State from Massachusetts.

JOHNSON (J. P.). **Report of Scouting and Quarantine Enforcement for the Japanese Beetle and Asiatic Beetle.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 737–744. New Haven, Conn., April 1929.

During the summer of 1927, the Japanese beetle [*Popillia japonica*, Newm.] was found in two localities outside the quarantined area, which was therefore extended eastward. No further extensions were made during 1928. An account is given of the scouting and quarantine work carried out during the year. The first beetle was found on 5th July and the last on 13th October.

Scouting for the Asiatic beetle [*Anomala orientalis*, Waterh.] was carried out in conjunction with that for *P. japonica*. In one locality the infestation was much less than when first discovered, only two lawns being attacked, whereas in the other locality the infestation appeared to be more intense than in the spring of 1926. In this area control work carried out in the spring and autumn of 1926 and the spring of 1927 resulted in checking the infestation, but owing to the fact that no extensive control work was undertaken during the autumn of 1927 and the year 1928, the infestation increased in extent and density. The first beetle was reported on 26th June and the last on the 29th August, adults being readily found during the height of the season in the heavily infested area. A brief summary of the quarantine and inspection work is given.

BRITTON (W. E.). **The Periodical Cicada or Seventeen-Year Locust in 1928.** *Tibicina septemdecim* **Linn.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 744–751, 3 pls., 2 figs., 2 refs. New Haven, April 1929.

According to expectations brood II of the periodical cicada, *Tibicen* (*Tibicina*) *septemdecim*, L., appeared in Connecticut in 1928 in practically the same areas as in 1911, but in some localities it was less abundant. A map of its distribution in 1928 is given. The period of emergence extends over about 6 weeks, and within a week or so of their appearance the adults have paired and commenced to lay their eggs. All stages of the insect are very briefly described. The chief injury is due to the egg-punctures, which cause the splintering of twigs and young branches and frequently result in their breaking off completely; the damage caused by the feeding of the larvae and adults is considered negligible. Young orchards injured by *T. septemdecim* should be heavily pruned in the following winter or spring to remove most of the damaged wood and to promote the vigorous growth of new and stronger branches.

No parasites have been found in Connecticut, and birds are probably the most important enemies. In general, preventive or control measures are hardly practicable against this pest, but small choice trees may be protected by covering them with mosquito netting.

Dusting the newly-emerged adults with pyrethrum in the early morning when they are covered with dew has been recommended, and a spray of Bordeaux mixture, lime-sulphur or whitewash appears to exert some repellent effect. Nicotine sulphate (1 : 500) with the addition of soap, and oleoresin of pyrethrum [*R.A.E.*, A, xiv, 656], sprayed on the adults, both gave 100 per cent. mortality in cages.

WHEELER (W. M.). **Two Neotropical Ants established in the United States.**—*Psyche*, xxxvi, no. 2, pp. 89–90, 2 refs. Boston, Mass., June 1929.

With reference to a recent paper on two neotropical ants [*R.A.E.*, A, xvii, 383], the author points out that *Iridomyrmex iniquus* var. *nigellus*, Emery, has been present in greenhouses in Boston, Mass., for more than twenty years and was probably introduced in soil with tropical plants some years before 1908, and that *Wasmannia auropunctata*, Roger, is undoubtedly established in tropical Florida, as he received specimens from that State some five years ago. It is probable that both may eventually become established in greenhouses in many parts of the United States, but they will only be able to survive out of doors in the very restricted tropical portions of the country.

COLE (A. C.). *Archanara subcarnea* **Kell. (Lepidop., Noctuidae) a Host of** *Masicera senilis* **Rond. (Dipt., Tachinidae).**—*Ent. News*, xl, no. 7, p. 225. Philadelphia, Pa., July 1929.

Two females of *Lydella* (*Masicera*) *senilis*, Rond., an important parasite of *Pyrausta nubilalis*, Hb. (European corn borer), were reared from a larva of *Archanara subcarnea*, Kell., taken in Michigan in the summer of 1928.

THOMAS (C. A.). **A Method for Rearing Mushroom Insects and Mites.**—*Ent. News*, xl, no. 7, pp. 222–225. Philadelphia, Pa., July 1929.

Commercial mushroom spawn in quart bottles was found to be an excellent medium for rearing and observing mushroom insects and mites, and it is probable that other fungus insects could be reared in the same manner. Contamination by mites on the insects to be reared or by moulds on the medium should be prevented as much as possible. The bottles of insect colonies should be kept in a somewhat humid atmosphere, as many species of Collembola cannot survive the drying of the cultures. Tight cotton plugs are placed in the mouths of the bottles, which are kept at room temperatures (50–65° F.). The mushroom mycelium provides excellent food for the insects ; eggs are laid and develop close to the glass where they can easily be observed with a binocular microscope. Insects reared in the above medium include : *Sciara coprophila*, Lint., and *S.* (*Neosciara*) *pauciseta*, Felt., many of these being reared for long periods (1½ years in one case) in the same bottle ; a parasite of these flies belonging to the genus *Calliceras* (*Ceraphron*) and probably a new species ; an unidentified Cecidomyiid, the larvae of which were collected in mushroom caps and beds ; and several species of Collembola. Mites are easily reared in the

spawn bottles; in fact it is difficult to obtain pure cultures of mushroom insects on account of mite infestation. The chief species are Tyroglyphids, especially *Tyroglyphus lintneri*, Osb.

St. George (R. A.) & Beal (J. A.). **The Southern Pine Beetle: a serious Enemy of Pines in the South.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1586, 18 pp., 17 figs., 2 refs. Washington, D.C., May 1929.

Most of this information on the biology and control of *Dendroctonus frontalis*, Zimm., is similar to that previously noticed [*R.A.E.*, A, ix, 390; xiv, 244]. The damage done by this beetle in the southern United States from 1891 up to the present day is estimated at £10,000,000. Outbreaks were recorded in 1922–23 and 1925–27, after which only a small percentage of the infested pines was salvaged.

A brief account is given of the appearance and biology of other Scolytids that might be mistaken for *D. frontalis*. The injury caused by larvae of the Lamiid, *Monochamus titillator*, F., often greatly reduces the salvage value of trees infested by *Dendroctonus*.

Where infested trees have been felled in sunny situations, the logs should be turned every few days so that the larvae under the bark are exposed to the sun and killed. Trees weakened by fire, wind or lightning are usually more liable to infestation, and within a radius of 3 to 4 miles burned areas serve as an attraction. Outbreaks rarely occur among pines growing in mixed hardwood stands; the better hardwood trees should, therefore, be encouraged in pure stands of pine.

During periods of drought trees should be carefully watched for signs of infestation.

Dampf (A.). **Una nueva plaga del nopal** (*Opuntia* **sp.),** *Cylindrocopturus biradiatus*, **Champion (Ins. Col., Fam. Curculionidae).** [*C. biradiatus*, a new Pest of Cactus.]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. Mexico*, iii, no. 1–4, pp. 7–17, 7 figs., 7 refs. S. Jacinto, D.F., 1929.

Cylindrocopturus biradiatus, Champ., is recorded as attacking cactus, *Opuntia* [*tuna*], in Mexico, where it is an important crop. The eggs are laid at the bases of the spines of the leaves. The larva does not mine the leaf, but remains below the base of the spine, feeding on the mucous secretions of the plant. This causes the base to turn yellow, giving rise to characteristic spots, from lines in which a white gum exudes. The larva pupates in the leaf-tissue.

D[ampf] (A.). **La avispa** (*Scelio fuscipennis* **Ashm.) como parasito de los canutos de la langosta en Mexico.** [*S. fuscipennis*, a Parasite of the Egg-pods of Locusts in Mexico.]—*Bol. mens. Defensa agríc. Sec. Agric. Fom. Mexico*, iii, no. 1–4, p. 18. S. Jacinto, D.F., 1929.

Scelio fuscipennis, Ashm., was obtained in 1926 from the egg-pods of the migratory locust, *Schistocerca paranensis*, Burm., in Mexico, this being the first record of the occurrence in that country of this type of parasite.

Tobler (F.). **Zikaden als Schädlinge des Henequen.** Homoptera as Pests of *Agave fourcroydes*.]—*Tropenflanzer*, xxxii, no. 6, pp. 253–259, 6 figs. Berlin, June 1929.

A detailed description is given of the injury to the tissues of *Agave fourcroydes* (hennequen) by the Jassid, *Homalodisca triquetra*, F. (*Phera vitripennis*, Grm.), in Mexico.

Tucker (R. W. E.). **Sugar-cane Borers.**—*Trop. Agriculture*, vi, no. 8, pp. 224–226. Trinidad, August 1929.

Two Braconid parasites, *Ipobracon grenadensis*, Ashm., and *Microdus* sp., were introduced into Barbados to control *Diatraea saccharalis*, F. (sugar-cane moth borer) in 1926–27 [*R.A.E.*, A, xvi, 529; xvii, 356, etc.], but although steps were taken to ensure that they were free from hyperparasites and to increase their numbers artificially, they apparently failed to become established.

The Chalcid, *Trichogramma minutum*, Riley, destroys 90 per cent. of the eggs of *Diatraea* at the end of the season and maintains itself subsequently in small numbers outside the cane fields, mainly in the eggs of *Utetheisa ornatrix*, L. Its artificial propagation has therefore been undertaken in order to obtain a high degree of parasitism early in the season. The parasites are reared in ant proof insectaries on eggs of *Sitotroga cerealella*, Ol. [xvii, 455] and are liberated when *Diatraea* is ovipositing, at the rate of approximately two and half millions a month, except in mid-July to mid-September, when the output is considerably increased. It is considered that 12,000 parasitised eggs are sufficient for every 15 to 16 acres of cane.

A strain of *T. minutum* obtained from Louisiana was found to give a higher and more uniform degree of parasitism than the indigenous one and completes its life-cycle in 9 days as compared with 10. It is thought that the local strain may be improved by cross-breeding.

Estimates in 1927–28 of damage done by *D. saccharalis* show that 20 per cent. of the cane crop is rendered unfit to harvest, and canes reaped suffer a loss of 5 per cent. in weight. About 55 per cent. of the canes were severely injured and only 10–15 per cent. were uninfested. This is quite apart from loss due to deterioration in purity of juice of bored canes.

Diaprepes abbreviatus, L., is also an important pest of sugar-cane and causes losses estimated at 5 to 6 tons of cane per acre.

Gallwey (A.). **Parasite Control of the Sugar-cane Moth Borer.**—*Bull. Imp. Inst.*, xxvi, no. 2, pp. 194–195; xxvii, no. 1, pp. 81–82. London, 1928–29.

The approximate annual loss to the sugar-cane crop in Antigua caused by *Diatraea saccharalis*, F., is at least 10 per cent. Attempts to control the moth by the Braconids, *Ipobracon* and *Microdus*, introduced from British Guiana, were begun in 1927. During the harvest of 1927–28, no parasites were found in fields in which they had been liberated, but there was a low percentage of infestation by the borer, though, as there were no control fields, results were inconclusive. Further work with parasites is to be carried out, and growers are urged to plant species of *Cordia*, the sweet secretion on the leaves of these plants being the natural food of the adult parasites.

Ogilvie (L.). **A Transmissible Virus Disease of the Easter Lily.**—*Ann. Appl. Biol.*, xv, no. 4, pp. 540–562, 4 pls., 17 refs. Cambridge, November 1928.

In transmission experiments to determine the vector of the virus disease "yellow flat" of the Easter lily (*Lilium longiflorum* var. *eximium*, known commercially as Lilium Harrisii) in Bermuda, positive results were obtained with *Aphis gossypii*, Glov., the Aphid most commonly found on these lilies. Experiments with *A. ogilviei*, Theo., *Macrosiphum gei*, Koch, *Neotoxoptera violae*, Perg., and *Pseudococcus citri*, Risso, were not successful. Attempts to transfer the disease mechanically were also unsuccessful, and there is no evidence that it is carried in the soil. The history and symptoms of the disease are discussed, and notes are given on the insect vector. Although the Aphid is found on various other ornamental plants and weeds and has been observed heavily infesting other species of lily, no other bulbous plant appears to be attacked, and the disease seems to be confined to lilies. The injury caused by the Aphid itself is slight, but the root system of diseased plants is often affected and attacked by secondary organisms, such as fungi, and the bulb mite, *Rhizoglyphus hyacinthi*, Banks, which is common in Bermuda soils, may subsequently burrow up the decaying roots into the base of the bulb and cause the condition generally known as "basal rot." In the author's opinion recovery from the disease never occurs.

The most important natural enemy of *A. gossypii* in Bermuda is the Braconid, *Lysiphlebus testaceipes*, Cress., which also attacks *A. nerii*, Kalt., and *A. pseudobrassicae*, Davis. *A. gossypii* becomes extremely abundant soon after its first appearance on the lilies, but within a few weeks its numbers are considerably reduced by the parasite. In 1926 the first case of parasitism was observed in the field on 20th December, and by 18th January 1927 few living Aphids were to be seen. The same phenomenon was observed in 1927–28. When the weather becomes warmer in March and April, the Aphid again becomes somewhat numerous and is not uncommonly seen on the flower buds in dark clusters. Predacious enemies include Syrphids and Coccinellids [*R.A.E.*, A, xvi, 445], larvae of *Chrysopa* spp., and the Anthocorid, *Triphleps insidiosus*, Say.

The remedial measures advocated are the systematic examination of lily fields every few weeks, with the removal and destruction of diseased plants (if plants are left lying at the sides of the field they tend to become badly infested with Aphids, which spread the disease to plants in the field), and the control of the Aphids either by dusting the plants during dry, sunny weather with nicotine, or by spraying with 40 per cent. nicotine sulphate at a dilution of about ¾ pt. to 100 gals. with the addition of 3–5 lb. soap, or this solution without soap in combination with Bordeaux mixture. No discarded bulbs should be left lying about, and no patches of lilies should be left to carry over the Aphid.

Bardales (M. A.). **El Café. Insectos nocivos.** [Pests of Coffee.]—*Bol. Agric. y Caminos*, viii, no. 5, pp. 185–188. Guatemala, May 1929.

A popular account is given of some pests of coffee in Guatemala, *viz.*, an Aphid, possibly *Toxoptera aurantii*, Boy. (*Aphis coffeae*, Nietn.),

and the Coccids, *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), *S.* (*Lecanium*) *nigra*, Nietn., *Coccus* (*L.*) *viridis*, Green, and *Dactylopius* sp.

EGGERS (H.). **Ipidae (Coleoptera) da America do Sul.** [Scolytids of South America.]—*Arch. Inst. biol.*, i, pp. 83–99. S. Paulo, 1928. (With a Summary in English.)

The species dealt with include *Hypocryphalus mangiferae*, sp. n., from mango (*Mangifera indica*), *Coccotrypes moreirai*, sp. n., from buttons made of palm-kernels, and *Xyleborus brasiliensis*, sp. n., from the woody parts of coffee bushes, all from Brazil; and *X. tolimanus*, sp. n., which is said to be a serious pest of cacao in Tolima, Colombia.

AUTUORI (M.). *Syneura infraposita* **Borgm.-Schmitz (Diptera, Phoridae). Um novo parasita da** *Icerya purchasi* **Mask.** [*S. infraposita*, a new Parasite of *I. purchasi*.]—*Arch. Inst. biol.*, i, pp. 193–200, 2 figs., 1 pl., 16 refs. S. Paulo, 1928. (With a Summary in English.)

The Phorid, *Syneura infraposita*, Borgm. & Schmitz, the larva and pupa of which are described for the first time, has been found parasitising the adults of the Coccid, *Icerya purchasi*, Mask., in S. Paulo, Brazil. About 25–35 larvae infest a single host.

HEMPEL (A.). **Descripções de novas especies de pulgões (Homoptera, Coccidae).** [Descriptions of new Coccids.]—*Arch. Inst. biol.*, i, pp. 235–237. S. Paulo, 1928. (With a Summary in English.)

A description is given of one new genus and three new species of LECANIINAE from Brazil, including *Pulvinaria paranaensis* on maté (*Ilex paraguayensis*) and *Ceroplastes diospyros* on persimmon (*Diospyros kaki*).

MONTEIRO (M. B.). **Uma broca do sapotiseiro "***Achras sapota* **L." (***Tomopterus vespoides*, **White).** [*T. vespoides*, a Borer of *A. sapota*.]—*Chacaras e Quintaes*, xl, no. 1, pp. 30–31, 3 figs. S. Paulo, 15th July 1929.

The Cerambycid, *Tomopterus vespoides*, White, infests the trunks and branches of *Achras sapota* in Brazil. The eggs are laid at the end of spring or early in summer. The larvae bore through the bark into the wood upwards, and then pupate, the adult emerging from October to December. The leaves of infested branches wither. A preventive measure consists in painting the trunks and branches with milk of lime containing carbolineum. Infested branches should be removed and burnt, and if the trunk is attacked, calcium carbide should be introduced into the holes, which should then be sealed.

BONDAR (G.). **A resina e os bichos de Jatobá.** [The Resin and Borers of *Hymenaea*.]—*Chacaras e Quintaes*, xl, no. 1, p. 44, 1 fig. S. Paulo, 15th July 1929.

The resin [gum copal] obtained in Brazil from the leguminous plants, *Hymenaea courbaril*, *H. steleocarpa*, etc., is exported for pharmaceutical use. Investigation has shown that this product is formed in

the pods owing to the wounds made by the ovipositing females of *Rhinochenus reichei*, Boh., and *R. stigma*, L., the entire development of which takes place within the pods. It is suggested that these weevils be encouraged. Other species found in the pods include one of the genus *Metoposoma*.

ROLFS (P. H.). **The Mediterranean Fruit Fly.**—*Florida Ent.*, xiii, no. 2, pp. 25–30. Gainesville, Fla., June 1929.

In view of the discovery of *Ceratitis capitata*, Wied., in Florida, the author gives an account of his observations on it in Brazil and shows the intensity of infestation in various fruits. Coffee, which is a favourite food-plant of the fly, is grown almost universally, but few berries ripen between seasons to carry it over, and where thorough cleaning up of the coffee plantations is practised, fruit and vegetables in the vicinity are rarely attacked. With regard to the influence of rain on the incidence of the fly, the first crop of Surinam cherries (*Eugenia uniflora*), which ripens towards the end of the dry season, is completely infested, whereas the second crop, which ripens in the rainy season, is almost free from attack. Observations on grapefruit showed that a large proportion of the larvae leave the fallen fruit within 24 hours, a fact that should be taken into consideration when removing and disposing of infested fruit.

GROSSMAN (E. F.). **Biology of the Mexican Cotton Boll Weevil. III. The Mechanism of Grub Feeding.**—*Florida Ent.*, xiii, no. 2, pp. 32–33. Gainesville, Fla., June 1929.

It is suggested that the larva of *Anthonomus grandis*, Boh., does not eat its way out of the cotton boll, because it prefers the soft interior to the hard shell, and therefore mechanically avoids the numerous dangers to which it would be exposed on the exterior of the boll. In experiments with infested bolls in which the outer shells had been made as soft as the contents, or the latter dried as hard as the shells, the grubs in both cases began to bore through the walls.

Division of Plant Disease and Insect Control. *8th Bienn. Rep. West Virginia Dept. Agric. 1927–28*, pp. 30–49. Charleston, W. Va. [1929].

The European corn borer [*Pyrausta nubilalis*, Hb.] was first discovered in West Virginia in 1926, and in 1928 it had become established in four counties, although no serious damage was done.

The oriental peach moth [*Cydia molesta*, Busck] is generally distributed over the eastern and northern sections of the State and is doing considerable damage locally.

The Mexican bean beetle [*Epilachna corrupta*, Muls.] is now distributed throughout the State and did considerable damage in 1928. Experiments have been carried out with various dusts and sprays. Spraying was found to be cheaper than dusting when labour is taken into account. The best results were obtained with a spray of calcium arsenate and Bordeaux mixture [*R.A.E.*, A, xiv, 490], and this was also the cheapest. Barium carbonate used as a spray, although acting as a good repellent, did not kill the beetles. Derrisol showed promising

results both as a killing agent and as a repellent. The same insecticides will control the bean leafhopper [*Empoasca fabae*, Harr.], which has done considerable damage both to beans and potatoes.

It has been observed that the adults of *E. corrupta* are most destructive on their first appearance after hibernation, 15th–25th May, and on the emergence of the first and second generations, about 10th–20th July and 25th August–5th September respectively. The damage done by larvae is greatest during the periods 25th June–5th July and 15th–25th August. The time for planting beans in relation to these periods is discussed.

In 1927 much damage was caused to maize by the stalk borer [*Papaipema nitela*, Gn.].

A very severe outbreak of the army worm [*Cirphis unipuncta*, Haw.] occurred in June 1927, and much damage was done to grass lands.

McDonald (R. E.). **Division of Entomology.**—*Ann. Rep. Comm. Agric. Texas 1927–28*, pp. 31–35. Austin, Tex., 1928.

As a result of the measures adopted [*R.A.E.*, A, xvi, 505], *Anastrepha ludens*, Lw. (Mexican fruit-fly) has not been found in the Rio Grande Valley since the spring of 1927. These measures are, however, being continued, as the fly is liable to be introduced from Mexico.

A law came into force in 1927 regulating the sale of sweet potato slips, and only tubers free from disease and from infestation by the sweet potato weevil [*Cylas formicarius*, L.] are passed as fit for commercial production of slips.

The area infested by the pink bollworm [*Platyedra gossypiella*, Saund.] has extended.

Branch (H. E.). **A new Record relative to the Parasites of *Pholus achemon* Drury.**—*Trans. Kansas Acad. Sci.*, xxxi, p. 100. Topeka, Kans., 1928. [Recd. May 1929.]

The Tachinid, *Frontina violenta*, Wlk., is recorded for the first time from *Pholus achemon*, Drury, in Kansas. This fly has been previously bred from *P.* (*Philampelus*) *vitis*, L., and *Vanessa antiopa*, L. *Sturmia distincta*, Wied., and *Winthemia quadripustulata*, F., are other Tachinid parasites of *P. achemon*.

Chapman (P. J.) & Gould (G. E.). **The Mexican Bean Beetle in Eastern Virginia.**—*Bull. Virginia Truck Expt. Sta.*, no. 65, pp. 677–697, 6 figs., 13 refs. Norfolk, Va., 1st October 1928 [*i.e.* 1929].

Epilachna corrupta, Muls. (Mexican bean beetle), all stages of which are described, first appeared in Virginia in 1922 and became generally established in the eastern part of the State in 1928. Beans are the preferred food-plant, but cowpeas and soy-beans [*Glycine hispida*] may also be attacked. Both larvae and adults prefer the leaves, but the pods may also be injured after most of the leaves have been destroyed.

The adults emerge from hibernation about the end of May or the beginning of June and begin to oviposit about 10 days later, mating having taken place either before or after hibernation. The oviposition period lasts about a month, a group of 40–50 eggs being laid every

2–3 days. The average number laid by a female is 558. There are normally 3 overlapping generations a year. Eggs and larvae of a fourth were present in November in 1928 when the plants were killed by frost. The seasonal variation in the length of the stages is shown in a table. The average length of the stages were: egg 6·73 days, larva 17·87, prepupa 2·99 and pupa 7·39. Hibernation usually takes place in well-drained wooded areas among leaf accumulation on the ground, but in one instance beetles were found passing the winter in an old bean field. The only natural enemy of *E. corrupta* observed in Virginia was *Podisus maculiventris* Say (spined soldier bug), which attacks all stages. High temperature and drought are unfavourable to the beetle.

Remedial measures include the growing of varieties of beans that mature during the cooler parts of the year, when attacks by *E. corrupta* are less pronounced. Infested plants should be ploughed in deeply immediately after the crop has been harvested, and the field subsequently harrowed. Failure to cover the plants completely, however, may provide conditions favourable to the hibernating beetles. Tests in burying the beetles at depths of 1–5 ins. in sand or loam showed that under certain conditions they can survive in dry soil for as long as 25 days, but none survived the winter.

Magnesium arsenate as a dust or spray [*R.A.E.*, A, xii, 167] is the best insecticide to use on beans, as it does not injure them to any extent. In western Virginia a spray of 1 lb. calcium arsenate, 2 lb. hydrated lime and 50 U.S. gals. water, and a dust of 1 part calcium arsenate and 7 parts hydrated lime gave good results, but in eastern Virginia near the coast these formulae caused severe injury to the plants. A dust of 15 lb. calcium arsenate, 15 lb. monohydrated or dehydrated copper sulphate and 70 lb. hydrated lime, applied at the rate of 14–15 lb. to the acre, is recommended where magnesium arsenate, which is more expensive, is not available.

Bean plantings should be carefully watched and dusted or sprayed as soon as the beetles appear and at intervals of 7–10 days until the pods have begun to form. If an arsenical is applied after the pods have formed, these should be thoroughly washed before consumption. With varieties of beans the pods of which are not consumed, it is better to delay the first treatment until the eggs are numerous but before many have hatched.

Directory of Field Activities of the Plant Quarantine and Control Administration. —*Misc. Pub. U.S. Dept. Agric.*, no. 47, 50 pp. Washington, D.C., 1st April 1929.

This directory summarises the activities of the Plant Quarantine and Control Administration of the United States Department of Agriculture, the list of field stations being arranged alphabetically by States.

Kellogg (V.), Headlee (T. P.), Gardner (V. R.), Quayle (H. J.), Cooper (T. P.), Dean (G. A.) & Morgan (H. A.). **Eradication of the Mediterranean Fruit Fly.**—*Science*, lxx, no. 1806, pp. 146–147. New York, N.Y., 9th August 1929.

In this report to the United States Secretary of Agriculture on the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] situation, it is stated that the region involved in the infestation is 34 per cent. of the area

of Florida, containing 72 per cent. of the bearing *Citrus*. The annual income from *Citrus* and other crops that may be affected is upwards of £12,000,000, and a capital investment exceeding £60,000,000 is threatened. Industries dependent upon citrus fruit represent an annual income of about £10,400,000. If the fly should spread to the South and West, still more enormous losses would be inevitable. Eradication of the pest is considered practicable in present known conditions, and it is recommended that this policy should be extended. The revised programme of work necessary to bring about eradication requires adequate inspection to determine the spread of the fly, certification of movement of host fruits or vegetables, removal of minor food-plants, destruction of flies and puparia, shortening of the cropping season and cleaning up of orchards and crops.

What Fruit Fly Invasion might mean to California.—*Mon. Bull. Dept. Agric. California*, xviii, no. 6, pp. 362–364. Sacramento, Cal., June 1929.

In view of the presence of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida and perhaps elsewhere in the United States, there is distinct danger of its spread into California, and a tabulation has been made of the probable losses to the industries that would be affected. The revenue derived from the sale of commodities susceptible to the fruit-fly is very large, and last year was estimated at about £77,000,000, and, either directly or indirectly, a very large percentage of the population of California would be affected by any disaster to the fruit and vegetable industries of that State.

County Horticultural Commissioners' Notes.—*Mon. Bull. Dept. Agric. California*, xviii, no. 6, pp. 365–367. Sacramento, Cal., June 1929.

H. J. Ryan reports that a campaign is being carried on in Los Angeles County against ants in *Citrus* groves, and particularly the Argentine ant [*Iridomyrmex humilis*, Mayr], on account of the protection they afford to the citrophilus mealybug [*Pseudococcus gahani*, Green]. Surveys are made for the purpose of discovering the infested groves, and then small receptacles containing poisoned syrup are distributed among the workers, to be attached to infested trees. These are replaced each spring and autumn, at least three treatments being given. It is considered significant of the success of this measure that whereas 357,826 containers were used during 1927, only 60,871 were required in the following spring. The paraffined paper cups have recently been replaced by aluminium containers. In one district, "honey ants" [*Prenolepis imparis*, Say] were found in numbers attacking the blossom on navel orange trees, eating into the unopened flowers and cutting through to tender growth; this was apparently because the flowers were late in opening and the honey was not available. The grey ant, *Formica cinerea*, Mayr, was also troublesome in shrubberies and trees, disturbing the work of beneficial insects. A heavy infestation of this species was eradicated by using double strength of Argentine ant syrup.

Laboratory production of *Cryptolaemus* [*montrouzieri*, Muls.] has reached a daily average of 100,000, and as the Coccinellids have shown early activity in the field, good control of the mealybug is expected.

A. A. Brock reports from Orange County the liberation of seven and a half million of the Coccinellids in 60 days, and these are being distributed at the rate of 700 per acre of infested orchards. The introduced parasites of the mealybug, *Tetracnemus* [*pretiosus*, Timb.] and *Coccophagus gurneyi*, Comp. [*R.A.E.*, A, xvii, 392], have been recovered on several occasions in the field, indicating that they have survived the winter, and it is hoped that they will be of considerable assistance.

Hill (C. C.) & Smith (H. D.). **The Hessian Fly in Pennsylvania.**—*Bull. Pennsylvania Dept. Agric.*, xii, no. 12 (Gen. Bull. no. 481), 11 pp., 13 figs. Harrisburg, Pa., 1st September 1929.

In the wheat-growing areas of Pennsylvania, infestation by the Hessian fly, *Mayetiola* (*Phytophaga*) *destructor*, Say, has greatly increased in recent years, and the situation appears very threatening for the next few years. An account is given of the fly, its history in Pennsylvania since 1921, and the usual methods of control, with special reference to fly-free dates for sowing wheat. There are 18 species of parasites in Pennsylvania that attack the spring generation and generally only two attacking the autumn one. Only six species are of any value in control, one of the most important being *Platygaster vernalis*, Myers.

Chamberlin (T. R.). **The Wheat Jointworm in Oregon.**—*Circ. Oregon Agric. Expt. Sta.*, no. 86, 7 pp., 2 figs., 1 ref. Corvallis, Ore., November 1928. [Received August 1929.]

Harmolita tritici, Fitch (wheat jointworm), which was first discovered in Oregon in July 1926, is doing much damage to wheat in two localities, up to 90 per cent. of the stalks being infested. A stem may contain as many as three infested joints, but usually only one is affected. The average number of larvae in each infested joint is 11. Emergence of the adults occurs from late April or early May to the end of the latter month or, if the weather is cold, to mid-June. Oviposition soon begins, the females containing from 45 to 124 eggs, most of which are fully developed at the time of emergence. Galls are sometimes formed before the eggs have hatched. Pupation takes place in October in the stems, and very few pupae fail to survive the winter. Reduction in the quality and quantity of the grain results from the larvae feeding on the sap, and the stems are weakened and deformed by the galls produced.

Deep autumn ploughing has been found to be a successful control measure. In cutting the wheat, the stubble should be left as high as possible to reduce the number of jointworms taken to the thresher, and straw stacks should be burnt. Where autumn ploughing is found impracticable, winter or spring ploughing should be carried out. Crop rotation is also recommended. In some parts of Oregon stubble fields are burned over to avoid the difficulty of burying the long and heavy stubble.

Bishopp (F. C.). **The Bollworm or Corn Ear Worm as a Cotton Pest.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1595, 14 pp., 12 figs., 7 refs. Washington, D.C., June 1929.

Severe damage, estimated at £1,700,000 a year, is caused to cotton in the United States by *Heliothis obsoleta*, F. (cotton bollworm), which

also attacks maize, tobacco, tomatos and many garden vegetables and wild plants. The nature of the damage to the crop is described.

One female may lay from 500 to 3,000 eggs. These are deposited on various parts of the plant, on weeds and upon the ground; on cotton only 20–40 per cent. are laid on the squares, blooms and tender growing tips. The larvae mature in from 12 to 70 days, the bulk of the damage being caused during the last days of active feeding. Pupation takes place in the soil, the overwintering pupae being found at depths of 4–6 ins., and those of the summer generations at depths of 1–4 ins. Under favourable conditions the life-cycle may be completed in 30 days and there are 4 or even 5 generations a year.

Cotton is usually attacked by the larvae of the third generation, and severe injury is caused in cloudy and rainy weather during the later part of July and in August. The moistening of the soil apparently assists the moths to emerge more easily, and the stimulating effect of the moisture on the growth of stalks and leaves of cotton favours the development of the larvae. Moreover, such weather conditions lessen the effectiveness of certain parasites of the bollworm.

Deep autumn and winter ploughing, particularly of land where infestation was known to have occurred in the autumn, is considered an effective control measure. Fence rows and other places, where the larvae may have fed on various plants, should also be deeply ploughed and disked.

As the hard ripe bolls are less subject to injury by the larvae, steps should be taken to make the plant mature before the moths begin to migrate from maize to cotton. As they hide in the leaves, varieties that produce little foliage are desirable. The early destruction of cotton stalks will prevent many late bollworms from reaching maturity. Maize should be confined to one area and not scattered over the plantation. In order to protect cotton, measures should be directed against the bollworm on cowpeas, lucerne and vetch. A poison bait consisting of 50 lb. wheat bran, 1 lb. Paris green or white arsenic (or 2 lb. powdered calcium arsenate), 2 U.S. gals. low-grade molasses and 3–4 U.S. gals. water, should be scattered over the fields at the rate of 10 lb. to the acre, or the fields may be dusted with calcium arsenate at the rate of 5 lb. to the acre. For the control of *H. obsoleta* on cotton, calcium arsenate dust should be applied between 10th July and 20th August, when the larvae begin to hatch and are feeding on the surface of the plant.

Where the cotton boll-weevil [*Anthonomus grandis*, Boh.] and *H. obsoleta* occur together, dusting with calcium arsenate is effective against both. Paris green can be applied as a spray (1 lb. to 50 U.S. gals. water) or as a dust (1 lb. to 3 lb. air-slaked lime), but it is liable to scorch the foliage. Lead arsenate is less toxic and more expensive than calcium arsenate. Dusting should be carried out at night when the plants are covered with dew, and two applications at an interval of 7–10 days usually give satisfactory results. The intensity of infestations varies from year to year, and the actual number of applications should depend upon the abundance of eggs deposited after the first application. An account is given of the use of maize as a trap-crop for protecting cotton, and it is pointed out that the former should be planted late enough to attract the moths when they are ovipositing [*cf. R.A.E.*, A, xv, 91]. The moths then concentrate on the maize from considerable distances, and the larvae are so numerous that they destroy each other and only a few of the many individuals hatching on the silk of each ear reach maturity.

Bridwell (J. C.). **Description of a Bruchid Immigrant into Hawaii breeding in the Seeds of Convolvulaceae (Coleoptera).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 6, pp. 112–114. Washington, D.C., June 1929.

The author discusses the synonymy of *Bruchus* (*Megacerus*) *pescaprae*, Fähr., described from seeds of *Ipomoea pescaprae* in Brazil, and considers that *Megacerus* is a distinct genus of which *Pachybruchus* is a synonym. He also refers to this genus various other Bruchids, all of which are associated with Convolvulaceae in America, the larvae living in their seeds, and describes *M. alternatus*, sp. n., which infests the seeds of *Ipomoea* spp. in Hawaii.

Swaine (J. M.). **The Biology of Canadian Barkbeetles. Introduction.** —*Canad. Ent.*, lxi, no. 7, pp. 145–146. Orillia, Ont., July 1929.

During the course of an investigation in Quebec, it was found that adults of *Dendroctonus piceaperda*, Hopk., *Polygraphus rufipennis*, Kby., *Ips perturbatus*, Eichh., and *I. borealis*, Sw., cut two sets of tunnels in the same season and in some cases hibernated and cut tunnels in the following season. Subsequently a series of detailed studies on the biology of Canadian bark-beetles was undertaken, and many species were found to cut more than one tunnel in the same season, so that what has previously been considered as a series of generations is, in these cases, a series of broods originating from the same adults. The results of these studies are to be published as a series of short papers of which the following is the first.

Simpson (L. J.). **The Seasonal History of *Polygraphus rufipennis* Kirby.**—*Canad. Ent.*, lxi, no. 7, pp. 146–151. Orillia, Ont., July 1929.

Polygraphus rufipennis, Kby., is widely distributed and abundant throughout the spruce forests of eastern Canada and the United States, attacking spruce, larch and, less commonly, pine. Hibernation takes place in the larval, pupal and adult stages in the bark of stumps, logs and tops of trees cut during the previous spring or summer. The adults emerge in May and June and readily attack the stumps, trunks and tops of trees recently felled or weakened in vitality by the attacks of other insects, such as the spruce budworm [*Tortrix fumiferana*, Clem.]. The entrance tunnel is cut by the female through the outer bark to the inner bark, where a flat chamber is made in which pairing takes place and from which the egg tunnels of several successive females radiate. The eggs are laid singly in deep niches on both sides of the egg tunnel, which is 1–2 ins. long. The larvae hatch in about five days and immediately begin their mines in the inner bark. When not crowded, the mines are quite regular, but generally they cross and intercross until the inner bark is almost completely destroyed. About 25 days later, the larvae pupate in a chamber at the end of the mine. In 7–10 days, transformation takes place, but the young adults hibernate in their original tunnels and do not emerge until May and June of the following year. Observations on this species under cage conditions show that one female may cut tunnels and lay eggs for two, three or even four distinct broods, extending over one or more seasons.

Adults from eggs laid in June 1925 emerged in June 1926, cut tunnels in June, July and September, hibernated in the third set of tunnels, and cut a fourth set of tunnels in June 1927, in which, however, both parents and brood died. The young adults from the eggs laid in June 1926 emerged in June 1927, cut tunnels in June and July, hibernated in the second set of tunnels, cut a third set of tunnels in June 1928, and died in them. The young adults from eggs laid in July 1926 emerged in June 1927, cut tunnels in June and July 1927, and both parents and brood were killed by a fungus during the winter. The young adults from eggs laid in September 1926 did not emerge until June 1928; they cut tunnels in June and July 1928, hibernated in their second tunnels and may emerge to cut a third set in June 1929. The progeny of these three broods of the same generation are further discussed, and a table is given summarising the information obtained over three generations from 1925 to 1928.

GILLIATT (F. C.). **The Bionomics of the Tortricid Moth,** *Eulia mariana* **(Fern.).**—*Trans. R. Soc. Canada*, sect. v, Biol. Sci., xxiii, no. 1, pp. 69–84, 4 pls., 7 refs. Ottawa, January 1929.

Eulia mariana, Fern., all stages of which are described, has been recorded from Nova Scotia, Maine, Massachusetts, Pennsylvania, and New York. In Nova Scotia it has been found on fruit trees, deciduous forest trees, bush fruits and a variety of weeds. The moths are nocturnal, but are not attracted to light. The eggs are laid in May and June on the upper surface of the leaves and on the smooth bark of the larger branches of trees, usually in shady places. In confinement oviposition usually began 5–6 days after emergence, the maximum number of eggs from one pairing being 273, in 8 egg-masses. A moth may continue oviposition at intervals for as long as 2 weeks. The average length of adult life in the laboratory was 14 days, the maximum being 23.

The young larvae, which hatch in 15–26 days, disperse quickly over the food-plant and begin feeding on the lower surface of the leaves, skeletonising them under a silken web. The older larvae bind leaves together, or on to the fruit, which may be badly scarred. The larval life lasts 72–84 days. When mature, the larvae pupate, after 6–12 days' inactivity, in rolled-up leaves, the pupal period lasting 7 or 8 months. The damage to fruit, which occurs from August to October, is generally on the surface, but the larvae sometimes make large tunnels in the interior. As a defoliator, the insect is not likely to be very injurious. An equal infestation on different varieties of apples gave very different results as to injured fruit, those with heavy foliage round the fruit suffering most seriously.

The moths do not readily cross open fields between orchards, but if such fields are waste land, with low-growing shrubs, the spread is more rapid. The larvae often drop from the trees and are therefore liable to be transported during fruit-picking, etc. The pupae are often carried in rolled-up leaves picked with the fruit, or in waste material. As they overwinter in old leaves on the ground, clean cultivation, with ploughing in the spring or autumn, will destroy them. Since the moth appears to have adapted itself from forest to apple trees, forest areas adjacent to orchards increase the danger of infestation. Once it is established, however, it is doubtful if the

presence of forest is any further danger. The presence of weeds also assists in carrying it over, in small numbers at least, from year to year.

A few Dipterous and Hymenopterous parasites reared from the larvae in Nova Scotia in 1926 and 1927 do not constitute an effective control. Considerable injury has been caused in orchards that have been carefully sprayed or dusted, receiving 5–7 applications of insecticides, and it is evident that the moth is not controlled by arsenical treatments as generally applied.

SHELFORD (V. E.). **Laboratory and Field Ecology. The Responses of Animals as Indicators of correct Working Methods.**—Med. 8vo, xii+608 pp., 219 figs. London, Baillière, Tindall & Cox, 1929. Price 45*s.* net.

The author describes this important contribution to laboratory and field ecology as an endeavour to present the results of experience in researches aimed first at the discovery of the way and conditions of life of animals in nature and then at their transplantation into the laboratory for scientific control in experiments simulating natural conditions as closely as possible. He explains the selection, installation and operation of equipment for different kinds of climatic simulation to suit the organism under observation. In the course of research to determine the equipment necessary, a great deal of ecological data and results were collected which are embodied in the present volume; there is therefore much in it to interest not only the research worker, but also the student of this comparatively unexplored field. The first six chapters are confined largely to defining the viewpoint of animal ecology and to showing the setting of its problems, especially those that lend themselves to experimental work. Succeeding chapters deal with the relations of organisms to particular factors of the environment and with the methods of measuring and controlling each factor.

The most important hibernation and aestivation phenomena in general physiological and practical work are those exhibited by insect pests, and considerable space is devoted to a discussion of the theories regarding these phenomena.

The bibliography includes over a thousand titles.

WILKINSON (H.). **Annual Report of the Entomologist, 1928.**—*Ann. Rep. Dept. Agric. Kenya 1928*, pp. 172–186. Nairobi, 1929.

Since the publication of the previous report [*R.A.E.*, A, xvii, 49], *Stephanoderes hampei*, Ferr., has been discovered on coffee in Kenya. The method of its introduction is not known, but it was first observed in coffee from a neglected area where the crop had been grown continuously for 30 years. All the coffee trees on that area were cut down and burnt, the plantation cleaned up and the coffee in store fumigated. Many other estates were subsequently found to be infested; draft regulations regarding control measures were drawn up and a grant of £5,000 was made to carry out a campaign against the borer. Observations indicate that the duration of the immature stages is longer than that of similar stages in Uganda and that the length of the adult life is shorter.

The mealybug, *Pseudococcus lilacinus*, Ckll., is still the most important coffee pest; in spite of many attempts at control [xvi, 308], no really satisfactory remedy has been found. In searching for *S. hampei*, considerable injury was found to be caused by an unidentified Longicorn, both larvae and adults of which destroy the tissues of the bean. The larva begins the attack along the longitudinal furrow, so that when half eaten the bean appears boat-shaped, and in this state it is often left for fresh beans. Sometimes nothing but an empty shell of parchment with a few holes in it is found within the hard coffee berry, the exit hole in the berry being slightly oval. Eggs are apparently laid outside the berry, and the young larva bores through to the bean, the adult eventually enlarging this hole for an exit; pupation occurs within the bean and no cocoon has been observed. Only the hard, black berries are attacked. *Antestia* has been more prevalent in some localities and has caused considerable falling of the berries. Recently planters have been using a poison spray of $\frac{3}{4}$ oz. sodium arsenite (or 1 oz. in wet districts) with $2\frac{1}{2}$ lb. jaggery or coarse sugar and 4 gals. water. In districts where rain is frequent, this spray in the form of a fine mist was not very successful, and it was therefore applied directly to the main stem with rather better results. As the Scelionid egg-parasites were not present in these areas, an attempt was made to introduce them from other districts, but the numbers obtained were too small to be of use. In Nyanza Province, the larvae of *Metadrepana andersoni*, Tams, defoliated some 700 acres of coffee; they can easily be destroyed by spraying the bushes with 3 lb. lead arsenate powder to 100 gals. water.

Notes on various coffee pests are contributed by H. C. James. *Anthores leuconotus*, Pasc. (white borer) is in flight during the short rainy season, but the beetles are difficult to catch as they conceal themselves under the foliage of the coffee plant. The adults frequently give indications of a coming attack by gnawing the green bark of the internodes. Eggs are generally laid on the main stem above ground level, and the larvae hatching from these do the greatest damage, as they ringbark the stem and decorticate the tap-root, speedily killing the tree. Eggs may also be laid much higher up on the main stem or on the primaries; the larvae from these never descend to the roots, but bore down between the bark and the wood. The pupal stage lasts from 38 to 42 days, and when the adult leaves the tree, the latter is usually quite dead. The best remedy is to catch and destroy the young larvae. If friction is applied to the bark of the stem for 2 or 3 inches above and below ground level, the bark covering the larval passage comes away, revealing the long strands of frass produced by the larva. For larvae that have already penetrated further into the wood, a fairly thick wire curved at the end should be used. This work should be done in January and February.

Dirphya princeps, Jord. (yellow coffee borer) is on the wing at the beginning of the long rainy season. Eggs are usually laid in the lateral branches a few inches from the tip. The female makes a hole in the green bark and deposits an egg in it; the young larva bores into the stem and then along it, following the direction of the cambium, and on reaching the main stem, turns downwards, sometimes going below ground-level to the roots. Small horizontal passages are excavated at frequent intervals along the burrow, giving the stem an appearance of shot-hole; from these frass is extruded. The larva reaches ground level about July or August. Towards the end of the year pupation

occurs at the base of the vertical burrow in a cell contructed of frass ; the total life-cycle occupies about a year. The best treatment is to cut off and destroy infested primaries before the larva reaches the main stem ; infestation is indicated by the presence on the ground of the characteristic frass, generally during April and May. If the larva succeeds in reaching the main stem, the burrow should be traced back to the primary from which it originated; this should be cut off near its base, and all exits of the lateral burrows plugged up with clay or putty. Carbon bisulphide or kerosene should then be poured down the burrow at the point where it enters the main stem from the primary, and the entrance to the burrow plugged up.

Experiments with *Pseudococcus citri*, Risso, which is a rather serious pest in Uganda but has not yet caused much damage in Kenya, proved that this species, which infests the roots, although it closely resembles *P. lilacinus*, is not capable of adapting itself to the subaerial mode of life adopted by the latter. *Asterolecanium coffeae*, Newst. (fringed scale of coffee), owing to its low reproductive capacity and because it is not attended by ants, spreads relatively slowly, but once established, is very difficult to eradicate. Slightly infested trees should therefore be treated promptly and continuously until clean. Treatment should be begun immediately after the rains, when reproduction is at its maximum and is followed by a migration of the larvae from the old bark on to the young green shoots. Wind and cultural operations assist in dissemination. Stumping and burning is the only remedy for badly infested trees, the stumps being afterwards scrubbed with a strong contact insecticide and then limewashed after the suckers have come away. The suckers should be carefully watched for possible reappearance of the pest. For less severe infestations, scrubbing the trees with a strong contact insecticide about once a fortnight should be sufficient. Infested green shoots should be pruned and the prunings burnt. Four species of internal parasites of this Coccid have been found, but they do not appear to be of much value ; a predacious Coccinellid is sometimes quite numerous. *Coccus* (*Lecanium*) *viridis*, Green, is another potentially dangerous pest, as it has great reproductive powers and only four known species of internal parasites. *Ceroplastes ceriferus*, And. (waxy scale) is not likely to become a serious pest in Kenya as it is highly parasitised ; seven species of internal parasites are known. *Saissetia nigra*, Nietn. (black scale) has six internal parasites, but at least one hyperparasite also occurs. Both this and *C. ceriferus* are well attended by ants and have great powers of rapid reproduction. *S.* (*Lecanium*) *coffeae*, Wlk. (*hemisphaerica*, Targ.) (brown scale) also occurs on coffee, and one species of parasite has been obtained from it.

On maize the campaign against *Busseola fusca*, Fuller [xvii, 49] has been continued with such success that the regulations concerning it have been temporarily revoked. Cutworms and armyworms were so numerous in some districts that replanting of maize was necessary.

The locust, *Schistocerca gregaria*, Forsk., was present over large areas and caused much damage, the swarms in some cases being 60 miles long and 3 miles wide. Some observations on this species are recorded. Contrary to the general belief, eggs were observed to hatch over wide areas without any rain having fallen subsequent to oviposition. The period between oviposition and appearance of the young hoppers varied according to the altitude, temperature and perhaps the moisture content of the soil, 12 days at 3,300–3,400 ft. being the shortest period observed.

FRAPPA (C.). **Les insectes nuisibles au riz sur pied et au riz en magasin à Madagascar.**—*Riz et Riziculture*, iii, no. 4, pp. 167–184, 1 pl., 7 figs., 12 refs. Paris, 15th August 1929.

One of the principal pests of rice in Madagascar is *Locusta migratoria migratorioides*, Rch. & Frm., which attacks most cultivated plants, but not vanilla and cassava. The eggs hatch in 15–30 days, and the adult stage is reached 30–50 days later. In 3 months in 1926, during the 1925–28 outbreak of the locust, the rice exported from certain parts of the island was 15,000 tons less than during the corresponding period of the previous year. Protective ditches and barrage traps are the means of control employed. Another Acridid attacking rice is *Phymateus puniceus*, Bol.

The Pentatomid, *Diploxys fallax*, Stål, does less damage than formerly, but should it increase, the stubble should be left rather long at harvest and then burnt. Land near the fields should be kept free from weeds. The Dynastid, *Heteronychus plebeius*, Klug, attacks rice, sugar-cane and maize, the larvae feeding on the roots, and most damage being done during dry years. Exposing the larvae by turning up the soil and allowing ducks, etc., to feed on them, and keeping the fields well flooded are the best means of control. The Hispid, *Trichispa sericea*, Guér., usually appears in Madagascar in August–September, and weakens or even kills the rice plants by feeding on the leaves. The best control is good irrigation. *Hispa gestroi*, Chap., also feeds on the leaves.

Cnaphalocrocis medinalis, Guen., oviposits at the top of the rice stalks in August–September, and the larvae bore into the stalks. They may reduce the harvest by as much as 60 per cent. during a dry season. The infested ears and stalks should be destroyed, and the stubble should be cut as low as possible when harvesting and the standing stubble burnt.

In Madagascar, *Calandra oryzae*, L., attacks almost all stored commodities, but does most damage to rice. It appears to have 5–8 generations a year. *Tribolium navale*, F., is often found with it. *Sitotroga cerealella*, Ol., sometimes attacks growing rice, particularly if the harvest is delayed, but does most damage to stored rice and is generally found in association with *C. oryzae* and *T. navale*.

WORMSER (C.). **Insectes nuisibles aux riz en Cochinchine.**—*La Cochinchine agric.*, ii, no. 12, December 1928. (Abstract in *Riz et Riziculture*, Extr. & Anal., iii, no. 4, pp. 129–130. Paris, 15th August 1929.)

Pests of rice in Cochin China include *Cnaphalocrocis medinalis*, Guen., *Schoenobius bipunctifer*, Wlk., *Scirpophaga nivella*, F. (*auriflua*, Zell.), *S. monostigma*, Zell., *Parnara mathias*, F., *Chilo simplex*, Butl., *Sesamia inferens*, Wlk., *Podops* sp., *Nephotettix* spp., *Hispa armigera*, Ol. (*aenescens*, Baly), and *Alesia discolor*, F. *Sitotroga cerealella*, Ol., *Calandra oryzae*, L., and *Tribolium castaneum*, Hbst. (*ferrugineum*, F.) infest stored rice.

SAVIO (P. A.). **Longicornes du bas Yang-tsé. Genre** *Linda*.—*Notes Ent. chinoise*, 9 pp., 1 pl. Shanghai, Univ. l'Aurore, 10th March 1929.

Linda fraterna, Chevr., a description of which is given, is recorded from China on *Prunus japonica* and *Cydonia japonica*. Peach is

occasionally attacked, and in the autumn of 1924 all the young branches of an apple tree imported from Japan were damaged by this Lamiid. The larva hollows out the twigs. The method of emergence of the adult is described. The larvae are attacked by a small Hymenopterous parasite, 40 of which may emerge from a single host.

Mukerji (S.). **A short Note on a Lymantrid Caterpillar** (*Dasychira mendosa*) (?) **Hubn. feeding on Mango Leaves.**—*J. Bombay Nat. Hist. Soc.*, xxxiii, no. 2, pp. 458–460, 1 fig. Bombay, 15th February 1929.

A description is given of a Lymantriid larva, believed to be *Dasychira mendosa*, Hb., found feeding on mango leaves near Calcutta on 13th March. It pupated the next day, and the adult emerged 8 days later.

Hazelhoff (E. H.). **Entomologisch onderzoek.** [Entomological Investigation.]—*Jaarsversl. Proefst. Java Suikerind. 1928*, pp. 96–111. Surabaya, 1929.

This is the entomological section of the report for 1928 of the Java Sugar Experiment Station at Pasoeroean. Observations on the parasitism of the white woolly aphis [*Oregma lanigera*, Zehnt.] by the Chalcid, *Encarsia flavoscutellum*, Zehnt.] in sugar-cane fields [*R.A.E.*, A, xvi, 628 ; xvii, 233] were continued in 1928–29. It was shown that the character of an infestation could be gauged in advance by the percentage of parasitism. This percentage may be determined by microscopic examination of samples of the Aphids, after clearing in a saturated solution of chloral hydrate in benzene. Sampling should be limited to doubtful cases ; if parasitism is abundant, it may be detected by the occurrence of Aphids with the exit-holes of the parasite, the presence of the parasite among the Aphids before 9–10 a.m. (it disappears later on in the morning), and the partial or total absence of young Aphids owing to parasitism of old individuals. Artificial measures should always be applied to the upper leaves, as the Chalcids are more numerous on the lower ones. Early-planted cane-fields suffer most, because the Chalcid is scarce at the time (June–July) when the Aphids appear in them.

In Java, records of the cane-borer, *Chilo infuscatellus*, Sn., include another species [*Diatraea auricilia*, Dudg.], which occurs in India. *Scirpophaga intacta*, Sn., is the only borer that infests old cane in abundance. In the case of borers in young cane, the injury is greater if the general growth conditions are unfavourable. Furthermore, *C. infuscatellus*, *D. auricilia*, *Sesamia inferens*, Wlk., and *Eucosma* (*Laspeyresia*) *schistaceana*, Sn., which migrate from one young shoot to another, do so more easily in slow growing cane. In an observation of the appearance of the first larvae in young cane, *D. auricilia* was found on 31st July, *S. inferens* on 15th August, *E. schistaceana* and *S. intacta* on 28th August, *Diatraea venosata*, Wlk., on 23rd October, and *C. infuscatellus* on 7th November. Observations from October 1927 to June 1928 showed that before 1st January 64·2 per cent. of the egg batches of *S. intacta* were parasitised by *Phanurus beneficiens* var. *elongatus*, Ishida, and only 37·3 after 1st January. In August 1928, 45 per cent. were parasitised in young cane only two months old ; there is therefore no interruption of parasitism such as occurs in the case of *E. flavoscutellum*.

From August 1927 to July 1928 an examination was made of parasitism of the eggs of various borers. Here again *Phanurus* parasitised 62·9 per cent. of the egg batches of *S. intacta* before 1st January, and 31·7 after that date. The corresponding figures for *D. venosata* were 78·6 and 87·5. In the case of *Trichogramma* sp., the figures were 4·1 and 1·0 for *D. venosata* and 80·1 and 9·5 for *E. schistaceana*. *Eripternimorpha javensis*, Rohw., parasitised 11·3 per cent. of the pupae of *S. intacta*, and even 15·3 per cent. in some cases. In the same plantations *Elasmus*, which attacks the larvae of this moth, was particularly scarce. In some estates in West Java *S. intacta* attacked 40–50 per cent. of the cane ; in East Java 25 per cent. was considered high. The varying degree of infestation in different varieties of cane is discussed. Of the various measures tried against this moth, the systematic cutting out of infested shoots appears to be the best.

The removal of the queens from the nests of *Termes gilvus*, Hag., in October 1927 had resulted in the destruction of the colonies by June 1928.

Lachnosterna (*Holotrichia*) *helleri*, Brenske, is the most harmful species of white grub at Pasoeroean. Pupation occurred in July or August, and the beetles emerged about a month later. Pupation was therefore much earlier than in 1914, when larvae were seen as late as the end of October. The adult remains for months underground in the pupal chamber, at a depth of 3–4½ feet. The first adults on the wing were seen on 10th November ; they seem able to work their way to the surface as soon as rain has softened the soil. Attempts should be made to collect the females immediately the beetles appear in numbers, as oviposition occurs almost at once.

Hazelhoff (E. H.). **Bestrijding der witte wolluis.** [Work against the White Woolly Aphis.]—*Arch. Suikerind. Ned.-Ind.*, 1929, no. 28, pp. 669–676, 2 pls. ; reprinted as *Korte Meded. Proefst. Java-Suikerind. Pasoeroean*, no. 22, pp. 669–676, 2 pls. Surabaya, 1929.

The investigations on the Chalcid parasite, *Encarsia* [*flavoscutellum*, Zehnt.] in 1927–28 and 1928–29 [see preceding abstract] show that it is more effective than artificial measures in controlling the white woolly aphis [*Oregma lanigera*, Zehnt.] on sugar-cane in Java. The method of preparing a sample for determining parasitism [*loc. cit.*] is described ; 1,000 gms. of chloral hydrate in 600 cc. benzene is sufficient for about 500 Aphids. A solution that is not quite saturated may also be used. The Aphids become transparent in 12–24 hours and are examined under a magnification of ×10—×20. Sometimes the parasitised Aphids are of lighter specific weight than the fluid and tend to collect at the edge of the dish. Very young Aphids must not be considered when making the examination. As the Chalcid is less abundant on the upper leaves, one set of samples must be taken from the topmost leaves and another from the lowest ones. When the parasite has become numerous, its presence can be detected by various indications [*loc. cit.*], including the partial or total absence of winged Aphids, because winged forms are not produced by parasitised individuals. No definite estimate can yet be given of the value of introducing *Encarsia* before the Aphid has established itself in young cane.

[Plotnikov (V.).] **Плотников (В.). Contribution to the Question of the Control of the chief Pests of Cotton.** [*In Russian.*] —*Khlopkovoe Delo,* viii, no. 5–6, pp. 579–584, 1 ref. Moscow, May–June 1929.

This is a review of the chief pests of cotton in Central Asia observed by the author in 1925–28, all of which have been previously noticed [*R.A.E.*, A, xii, 555; xiv, 507; xvi, 430; xvii, 149]. The relation between the infestation of cotton by these pests and temperature conditions is discussed. Thrips are particularly abundant when the development of the plants is retarded and their resistance to infestation decreased by low temperatures, whereas *Tetranychus telarius,* L. (*Epitetranychus althaeae,* v. Hanst.) is prevalent in hot summers, and *Aphis gossypii,* Glov., in warm and protracted autumns. It is possible that more than one species of thrips is responsible for the damage done to the cotton [*cf.* xvii, 477], but the one observed by the author was *Thrips tabaci,* Lind. Young plants suffer severely from its attacks, but may easily recover from them, the slightest improvement in the nutritive elements of the soil considerably raising their power of resistance. The author therefore recommends improved cultivation of the cotton rather than direct control of the thrips.

Infestation by *Tetranychus telarius* greatly weakens the plants, but experiments, the results of which are given, show that some varieties are more resistant than others, and that chemical manures considerably increase the crop. The best means of protecting cotton from infestation would therefore be to cultivate resistant varieties and improve the manuring, as the rapid reproduction of the mite makes direct measures against it comparatively ineffective. When, however, proper cultivation has been neglected, dusting with flowers of sulphur is recommended; applied at the rate of about 32 lb. to the acre it kills about 50 per cent. of the mites, while at 320 lb. it effects complete control. The best time for dusting is before 9 a.m. and after 5 p.m.

As healthy plants are infested by *Aphis gossypii,* direct measures against it should be employed; in order to prevent its migration to cotton in autumn from adjoining fields of cucurbits, the latter should be sprayed with soap solution or nicotine and soap, or preferably dusted with nicotine and freshly slaked lime.

[Galakhov (P.).] **Галахов (П.). The Effect of some Poisons on the chief Pests of Cotton in Central Asia.** [*In Russian.*]—*Khlopkovoe Delo,* viii, no. 5–6, pp. 584–585. Moscow, May–June 1929.

In experiments against *Tetranychus* sp., dusting with sublimed flowers of sulphur (45 lb. to the acre) killed 90 per cent.; spraying with soap of various makes at the rate of 1 lb. to 12½ pints water killed over 71–86 per cent., and with wheat flour at the same rate over 62 per cent. Against *Aphis gossypii,* Glov., the best results were obtained from sprays of soap containing a large percentage of fatty animal acids, the application of which at the rate of 1 lb. to 25 pints water killed 90 per cent. The preparations used had no effect on the cotton. The temperature at which the experiments were carried out was about 78° F. and the relative humidity 98 per cent.

Uvarov (B. P.). **The Desert Locust** (*Schistocerca gregaria*, **Forsk.**). [*In Russian.*]—12mo, 4 pp., 6 figs. Moscow, Chief Cotton Committee U.S.S.R., 1929.

This is a brief summary of data from the literature on the bionomics, distribution, parasites and control of *Schistocerca gregaria*, Forsk., which invaded nearly the whole of Transcaspia and the south-western part of Turkestan in 1929. It is probable that northern Khorosan and southern Transcaspia are the permanent breeding-places of the solitary phase of this locust, for isolated individuals have been found there on several occasions.

The periodic outbreaks of *Schistocerca gregaria* in general, and the invasions of 1915 and 1929 in particular, may be connected with the periodicity of the sun-spots; these have a direct influence upon the climate, which may be the governing factor in this problem.

Bodenheimer (F. S.). **A Contribution to the Study of the Desert Locust** (*Schistocerca gregaria* **Forsk.**).—*Hadar*, ii, no. 7, reprint 12 pp., 6 tables. Tel-Aviv, July 1929.

Advantage was taken of the opportunities offered by the recent invasion of *Schistocerca gregaria*, Forsk., in Transjordania to endeavour to solve some of the outstanding problems in its biology, and this article is a preliminary summary of an extensive treatise that is to appear shortly.

The first problem discussed is the effect of temperature and humidity on the development of the eggs. Laboratory experiments indicate that the optimum conditions are 100 per cent. humidity and a temperature of 25·5–30° C. [78–86° F.]. The permanent breeding-places of *S. gregaria* are situated in areas that border on deserts, but in which rainfall is still a climatic factor. If sufficient rain falls during the oviposition season and the temperature of the soil averages about 30° C. at that period, as many as 80 per cent. of the eggs reach maturity. Two favourable years in succession are sufficient, therefore, to cause a serious outbreak.

The author further discusses the relation of the body temperature of the locust to the temperature of the atmosphere and of the soil, and submits tables showing its behaviour throughout the day and its reactions to different temperatures, as well as the temperatures preferred by the various stages. Some mention is made of the experiments on the metabolism of the insect during its development, and a table is given showing the increase in weight during growth.

Malenotti (E.). **Un nemico della bietola saccarifera in Maremma: *Cleonus mendicus*, Gyll.** [*Conorrhynchus mendicus*, a Pest of Sugar-beet in the Marshlands of Tuscany.]—*Pagine agric.*, January–March 1929, reprint 20 pp., 15 figs. Leghorn, 1929.

The weevil, *Conorrhynchus* (*Cleonus*) *mendicus*, Gyll., is a serious pest of sugar-beet in some parts of the low-lying marshlands of Tuscany. In 1927, mating occurred in the second half of May and was immediately followed by oviposition, the eggs being laid in the soil. The larvae appeared in mid-June, attacking the roots at a depth of $1\frac{1}{4}$–$1\frac{1}{2}$ ins.,

and the greatest injury occurred at the end of July or early in August, after which they pupated. The pupal stage lasts about 3 weeks, but the adult does not emerge till the following spring.

There should be at least two years between successive crops of beet on the same ground. The migration of the adults can be prevented by trenches, having a vertical side 12 ins. high facing the infested field, with pots sunk in them 8–15 yards apart to trap the weevils. Further measures against the adults include hand-collection and spraying with 4 per cent. barium chloride, applied when the plants have two pairs of leaves and again 3–4 days later.

Menozzi (C.). *Rondania dimidiata* **Meig. (Dipt.) parassita del** *Cleonus mendicus* **Gyll. (Col.).** [*R. dimidiata*, a Parasite of *Conorrhynchus mendicus*.]—*Boll. Soc. ent. ital.*, lxi, no. 7, p. 119. Genoa, 3rd July 1929.

Adults of *Conorrhynchus* (*Cleonus*) *mendicus*, Gyll., in Tuscany [see preceding paper] have been found to be parasitised by *Rondania dimidiata*, Mg. The females are chiefly attacked, and in one locality 25–30 per cent. of them were parasitised, each weevil being infested by 2–3 or sometimes 5 parasite larvae.

Silvestri (F.). **Il Ceroplaste (o cocciniglia) del fico.** [The Species of *Ceroplastes* infesting Fig.]—*Circ. R. Lab. Ent. Agrar. Portici*, no. 4, 11 pp., 14 figs. Portici, 1927. [Recd. 1929.]

Ceroplastes rusci, L., sometimes causes considerable injury to figs in Italy. Infested trees are weakened, the ripening of the fruit being delayed or prevented, and may be rendered liable to the attacks of Scolytids. In coastal areas at altitudes of less than 300 feet the females oviposit in late May and June. They lay 800–1,500 eggs, which hatch in about 15 days. The larvae spread on the foliage, fruits and twigs, and are carried by wind to other plants. The adult stage is reached in August, when mating occurs, after which the males die. In late October or early November the females migrate from the leaves to the branches, where they remain until they oviposit in the following year. In sheltered positions there may be two generations a year. This Coccid also attacks *Ruscus aculeatus*, *Pistacia lentiscus*, *P. terebinthus*, and sometimes *Citrus*.

As a rule, *C. rusci* disappears after one or two years' severe infestation, reappearing after a more or less irregular interval. The factors controlling it include climatic conditions, parasitic fungi, such predacious beetles as *Chilocorus* and *Exochomus*, Chalcid parasites of the larvae, and a species of *Scutellista* that infests the eggs. The scales may be rubbed off the branches in winter, and sprays containing oil, tar-oil, or lime-sulphur are effective against the young larvae. Formulae for lime-sulphur are given.

Bremer (H.). **Zur Methodik epidemiologischer Untersuchung von Getreidefliegen-Kalamitäten.** [Notes on Methods of epidemiological Investigations of Outbreaks of Dipterous Pests on Cereals.]—*Anz. Schädlingsk.*, v, no. 6, pp. 70–73, 1 graph, 5 refs. Berlin, 1929.

Attempts to determine the abundance and injuriousness of *Mayetiola destructor*, Say, in the United States and of *Oscinella* (*Oscinis*) *frit*, L.,

in Germany are discussed [*R.A.E.*, A, xii, 307, 491 ; xiii, 575]. It is suggested that the determination of the intensity and duration of the flight by means of mass captures would facilitate the estimation of the extent of outbreaks of *Hylemyia coarctata*, Fall. This fly has only one generation a year and is on the wing from June till August. The degree of damage could only be predicted by determining the number and condition of the eggs in the fields in autumn [xvi, 298]. Twelve viable eggs to the square foot constitute a certain amount of danger. An attempt was made to secure such data by removing small portions of the surface soil about ½ in. deep from several places in the field ; the earth was sprayed with water and sifted through 2 or 3 sieves of diminishing mesh. The residue in the finest sieve was then poured into a glass vessel on a dark background and the eggs extracted from it with a brush. The relative infestation of various crops and some indication of the extent of the outbreak was thus secured. It appears that this method, if carried out from year to year in the same locality, will indicate variations in the degree of infestation by *H. coarctata*, and consequently lead to the recognition of conditions governing these variations and general prediction of attacks.

GÖTZE (G.). **Inwieweit wird die Bienenzucht durch die Verwendung zuckerhaltiger Pflanzenschutzmittel gefährdet?** [How far is Bee-keeping endangered by the Use of sweetened Materials for Plant Protection.]—*Anz. Schädlingsk.*, v, no. 6, pp. 73–75. Berlin, 1929.

The extent to which bees are likely to be injured by bait-sprays, the sugar content of which is liable to attract them, is discussed. The author is convinced that the danger is negligible and believes that much of the mortality observed among bees has been erroneously attributed to the use of insecticides. The fact that bees have been induced to feed on sugar solutions containing arsenicals or fluorides in the laboratory is considered to be no proof that they do so in nature.

SPRENGEL (L.). **Zur Bekämpfung der Pflaumensägewespe.** [On the Control of the Plum Sawfly.]—*Anz. Schädlingsk.*, v, no. 6, pp. 67–70. Berlin, 1929.

Recent work on the biology and control of *Hoplocampa fulvicornis*, Panz., in Germany is discussed [*R.A.E.*, A, xv, 557 ; xvii, 59, 333]. Studies carried out in the Palatinate in the spring of 1929 confirmed the discovery of the previous year that *H. flava*, L., also occurred on plums [xvii, 462], each of these sawflies showing a preference for different climatic conditions. *H. flava* is absent from situations exposed to cold, whereas *H. fulvicornis* is scarce in warmer ones. It appears probable that *H. flava* may attack cherries when they are growing close to plums, greengages or damsons. The simultaneous occurrence of the two species renders control much more difficult. Blossom sprays for the destruction of ovipositing females are not completely successful if both species are present or if the flight period is protracted, and bees may be killed by them. A brief account is given of the campaign organised in the Palatinate, together with the text of a popular leaflet giving instructions to fruit growers for the control of these sawflies.

Sprengel (L.). **Die Verwendung von Nosprasen bei der Bekämpfung der Pflaumensägewespe.** [The Use of Nosprasen in the Control of the Plum Sawfly.]—*Nachr. Schädlingsbekämpfung*, iv, no. 1, pp. 29–31. Leverkusen a. Rhein, March 1929.

The most successful results in experiments for the control of the plum sawfly [*Hoplocampa fulvicornis*, Panz.] were obtained by spraying the fruit with arsenicals at the beginning of the migration of the young larvae, about 8 days after the fall of the petals [*cf. R.A.E.*, A, xvii, 334].

Oudemans (A. C.). **Acarologische Aanteekeningen xcv.** [Notes on Acari, xcv.]—*Ent. Ber.*, vii, no. 165, pp. 393–399. Amsterdam, 1st January 1929.

The species dealt with include *Tydeus mati*, sp. n., and *Zetzellia zacheri*, sp. n., both from apple in North Germany.

Weber (H.). **Hemiptera. I.**—*Biol. Tiere Deutschlands*, Teil 31, pp. 1–70, 73 figs. Berlin, Borntraeger, 1929. Subscription Price, *M.* 3.60; single copies, *M.* 10.80.

This is the first section on Rhynchota of this work, of which some other parts have been noticed [*R.A.E.*, A, xv, 420], and gives a general account of the morphology of the Heteroptera.

van Poeteren (N.). **Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het Jaar 1928.** [Report on the Work of the Phytopathological Service in 1928.]—*Versl. Meded. Plantenziektenk. Dienst*, no. 58, 99 pp., 6 pls. Wageningen, July 1929.

Pests recorded in Holland in 1928 include *Pediculopsis* (*Pediculoides*) *graminum*, Reut., on rye, this being apparently the first record of this mite in that country; *Phytometra* (*Plusia*) *gamma*, L., on potato [*R.A.E.*, A, xvii, 123]; *Otiorrhynchus hungaricus* var. *lugdunensis*, Boh., and *Plesiocoris rugicollis*, Fall., which were very harmful to apple in some districts; the millepede, *Blaniulus guttulatus*, Gerv., which caused serious injury to strawberries in one plantation; *Brachyderes incanus*, L., which damaged pine needles in one locality but was controlled by an arsenical dust; and *Chermes* (*Gillettea*) *cooleyi*, Gillette, which was found for the first time in Holland, on *Pseudotsuga taxifolia* (*douglasi*).

Ritchie (J.). **Clover Mites** (*Bryobia praetiosa*) **invading Dwelling-house.**—*Scot. Nat.*, no. 178, p. 126. Edinburgh, July–August 1929.

An instance is recorded of the mite, *Bryobia praetiosa*, Koch, invading a house near Edinburgh in April in large numbers, the invasion, which lasted several weeks, being due to migration of the spring brood from surrounding pasture.

Smith (K. M.). **Studies on Potato Virus Diseases. IV. Further Experiments with Potato Mosaic. VI. Further Experiments with the Virus of a Potato Mosaic upon the Tobacco Plant.**—*Ann. Appl. Biol.*, xvi, no. 1, pp. 1–32, 5 pls., 8 refs. ; no. 3, pp. 382–398, 4 pls., 1 fig. Cambridge, February & August 1929.

Previous observations have already indicated that *Myzus persicae*, Sulz., is the main carrier of mosaic disease of potato in Britain [*R.A.E.*, A, xv, 200], and in the experiments here described further evidence of successful transmission by this Aphid was obtained. Attempts to induce other insects that feed on potato to transmit the disease proved negative, and it was not found possible to infect potato plants by inoculating them with the body juices or salivary glands of examples of *M. persicae* bred on diseased plants. Numerous cross-inoculation experiments are described in which the virus of potato mosaic was transferred by means of needle or Aphid from potato to tobacco and *vice versa*. The virus transmitted to healthy tobacco plants by *M. persicae* produced a characteristic spot and mottle disease that is considered to be substantially the same as that produced by needle inoculation, which is characterised by the formation of necrotic concentric rings with a central spot. Ring-spot when inoculated back into healthy potato by needle or Aphid reproduced the original mosaic, with the symptoms intensified and the infective power greatly enhanced. Although the Aphid readily transmits the virus of potato mosaic to tobacco, it transmits the resulting disease back to potato only with very great difficulty. The intensified mosaic can be spread from potato to potato by needle scratch with the greatest ease, but transmission experiments with *M. persicae* proved negative. The spot and mottle disease produced in tobacco by the Aphid, when inoculated back into potato by needle, produced the same intensified symptoms as the needle-induced ring-spot. Tobacco ring-spot can be transferred from tobacco to tobacco by needle or Aphid, though the latter produces the spot and mottle symptoms and the former a still more virulent form of necrosis. The experiments with tobacco indicate that *M. persicae* picks up the virus of potato mosaic with great regularity, but that under the prevailing experimental conditions it only occasionally transmitted the disease to healthy potato. Juice from a potato plant infected with intensified mosaic and a ring-spot tobacco plant was filtered, and the resulting filtrate originating from each plant infected healthy potato and tobacco plants with their respective diseases, thus showing that the ring-spot virus and its counterpart in potato are filter-passing entities. The virus of tobacco ring-spot produced some symptoms when inoculated into tomato, *Petunia* and *Datura*, but none in *Solanum nigrum*, spinach and cabbage.

In the second paper, further experiments with the virus of potato mosaic on tobacco plants are described, and the results obtained in the previous experiments are confirmed. By improved methods of technique, *M. persicae* was induced to carry infection with fair regularity from infected tobacco to healthy potato. Marked increase in virulence has been shown to occur in ring-spot when progressively inoculated by needle through successive tobacco plants, but whereas inoculation by needle from a plant affected with virulent ring-spot reproduces the virulent disease in a healthy plant, inoculation by Aphids only produces a mottle and dark green line disease, apparently the same as that produced by Aphid transmission from the ordinary type of ring-

spot. An analysis of a large comparative series of Aphid and needle inoculations with potato mosaic and tobacco ring-spot indicates that the Aphid-induced disease is an infectious virus of constant character, and that the Aphid fails to transmit the more lethal characters of the disease. In no case was the disease transmitted through the seed of infected tobacco plants.

DAVIDSON (J.) & HENSON (H.). **The internal Condition of the Host Plant in Relation to Insect Attack, with special Reference to the Influence of Pyridine.**—*Ann. Appl. Biol.*, xvi, no. 3, pp. 458-471, 11 refs. Cambridge, August 1929.

In the first part of this paper, which is by Davidson, the question of the relation of the internal condition of the food-plant to insect injury is reviewed. Attempts to confer immunity from insect attack have been based on the view that a plant may be induced to take up and absorb into its tissues traces of certain chemical substances which, although innocuous to the plant concerned, would by their presence render it unsuited or even toxic to the insects infesting it. The introduction of the chemical substances may be effected either directly into the roots or stems of the plant or into the medium in which the plant is growing. In 1924 the author began preliminary experiments by injecting various substances into the stems of growing plants of broad beans (*Vicia faba*) infested with Aphids, and continued them in 1925 when cut stems infested with *Aphis rumicis*, L., were placed in solutions of various chemicals. The favourable results obtained with pyridine watered on infested beans growing in sand and soil led to the experiments described by Henson in the second part of the paper, which were undertaken in an attempt to determine the strength of pyridine solution required to destroy the Aphids without injuring the plants. In suitable concentrations this substance was found to exercise a marked detrimental effect on the Aphids, but many factors, such as those governing its absorption by the plant and its effect on the plant after absorption, render the exact conditions difficult to define. When the bean plants were grown in sand, the effect on the Aphids was to a large extent proportional to the amount of pyridine administered. A comparison of the dry weights of treated and untreated uninfested plants grown in sand showed that a very evident detrimental effect had been produced by the pyridine. It appeared to have a less injurious effect on plants growing in soil, but was still effective against Aphids when present at a sufficiently high concentration, though a considerably higher one was necessary than in the case of plants grown in sand.

MACDOUGALL (R. S.). *Eccoptogaster ratzeburgi*, **Jans., on Birch in Scotland.**—*Proc. Ent. Soc. Lond.*, iv, pt. 1, p. 7. London, 31st July 1929.

An instance is given of *Scolytus* (*Eccoptogaster*) *ratzeburgi*, Jans., infesting birch in Scotland, in which country it had not been observed since it was first recorded in 1856. A piece of birch stem obtained from Bavaria that had also been infested by this Scolytid showed evidence that the bark had been damaged by a woodpecker in digging out the insects.

MacDougall (R. S.). **Insect Enemies of 1928.**—*Trans. Highl. Agric. Soc. Scotland,* 1929, reprint 41 pp., 30 figs., 10 refs. Edinburgh, 1929.

An account is given of some of the insect pests occurring in 1928, including notes on the bionomics of the following beetles that are destructive to felled, stored and worked timber : the Anobiid, *Ptilinus pectinicornis,* L., the Lyctids, *Lyctus linearis,* Goeze, *L. brunneus,* Steph., *L. planicollis,* LeC., and *L. parallelopipedus,* Melsh., the Scolytids, *Xyloterus* (*Trypodendron*) *lineatus,* Ol., and *X.* (*T.*) *domesticus,* L., and the Longicorns, *Rhagium bifasciatum,* F., *Saperda carcharias,* L., *S. populnea,* L., *Tetropium gabrieli,* Weise, *Acanthocinus aedilis,* L., *Callidium violaceum,* L., *C. aeneum,* DeG. (*variabile,* F.), *Pyrrhidium* (*Phymatodes*) *sanguineum,* L., *Hylotrupes bajulus,* L., and *Neoclytus capraea,* Say. Keys to the British species of the genus *Vespa* are given, and the bionomics and control of the household pests, *Monomorium pharaonis,* L., and *Lepisma saccharina,* L., are discussed. Notes are given on the bionomics of *Lochmaea suturalis,* Thoms. [see next paper], which causes considerable damage to heather. The beetles emerge from hibernation late in the spring, and there is an overlapping of generations, so that all stages from egg to adult may be found at the same time during summer and autumn.

Betrem (J. G.). **De heidekever en zijn biologie.** [The Heather Beetle and its Biology.]—*Tijdschr. Plantenziekt.,* xxxv, no. 6, pp. 155–180, 3 pls., 50 refs. Wageningen, June 1929. (With a Summary in German.)

The Galerucid, *Lochmaea suturalis,* Thoms., caused much injury to heather (*Calluna vulgaris*), which is its only food-plant, in Holland and Germany in 1927 and 1928, large areas being destroyed. The adults, both sexes of which hibernate, become active at the end of March, when they injure the heather, chiefly attacking the buds. The first eggs are laid in mid-May and the last early in July. The first larvae were observed on 30th May, after an egg-stage of 18–19 days. They feed on the leaves of the heather, which is often killed. The larva, here fully described for the first time, passes through 3 or rarely 4 instars. In the laboratory adults were obtained as early as 13th July, but in the field the first beetles did not appear before mid-September. They mate in September and then shelter under moss or forest litter, but very few hibernating beetles are found where the ground is covered with lichens. The chief enemy of *L. suturalis* is *Coccinella hieroglyphica,* L., the larvae of which in Holland feed exclusively on those of this Galerucid. The Coccinellid larva is described. The Reduviid, *Nabis apterus,* F., preys on the adults and larvae. Birds also destroy the beetles, and the fungus, *Sporotrichum epigaeum,* infests the pupae. The one measure available is burning the heather fields in spring or in July.

Schoevers (T. A. C.). **Een ongewone beschadiging door mijten aan jonge komkommerplanten.** [An unusual Injury by Mites to young Cucumber Plants.]—*Versl. Meded. Plantenziektenk. Dienst.,* no. 56, pp. 4–7, 2 pls. Wageningen, July 1929.

A Tyroglyphid mite, identified by Oudemans as *Tyroglyphus dimidiatus,* Herm. 1804 (*longior,* Gerv. 1844), destroyed many cucumber

seedlings, up to 90 per cent. in the case of one sowing, at Loosduinen, Holland, early in 1929. The mites were probably introduced in horse manure. Fumigation with nicotine is the remedy suggested.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1929.**—*Rev. Zool. agric.*, xxviii, no. 4, pp. 49–64, 3 figs. Bordeaux, April 1929.

The situation regarding *Leptinotarsa decemlineata*, Say, in France at the beginning of the 1929 campaign is reviewed [*cf. R.A.E.*, A, xvii, 18]. Owing to methodical work, the northern and southern limits of the infestation have remained more or less fixed since 1925. The discovery of two new series of infestations has caused the extension of the corresponding infested and protective zones, but the extinction of the pest, duly confirmed, in several isolated centres has permitted the regressive modification of the zones in these localities, the former infested zones being made protective and the protective zones being declared free from the pest, so that the total area under surveillance is, in fact, smaller in extent than in the previous year.

SCHNEIDER-ORELLI (O.), SCHAEFFER (C.) & WIESMANN (R.). **Untersuchungen über die Weisstannenlaus** *Dreyfusia nüsslini* **C.B. in der Schweiz.** [Studies of *Chermes nüsslini* in Switzerland.]—*Mitt. schweiz. Centralanst. forstl. Versuchswes.*, xv, no. 2, pp. 191–242, 4 pls., 27 figs., 49 refs. Zurich, 1929.

Chermes (*Dreyfusia*) *nüsslini*, Börner, which has been abundant and injurious on silver fir (*Abies* spp.) in Central Switzerland for a number of years, causes malformations of the new growth and destruction of individual branches or even of the whole tree. Microscopic examination confirmed the specific differences between *C. nüsslini* and *C. piceae*, Ratz. [*cf. R.A.E.*, A, xiii, 533]. Experiments also confirmed the fact that winged sexuparae leaving infested silver fir migrate to *Picea orientalis*, and can only complete the normal cycle of development, which includes sexual forms, fundatrices and gall generations, on this tree. After migration to *P. orientalis* in the spring, characteristic galls are formed, in which a new generation of winged Aphids develops and flies back to silver fir, where it produces parthenogenetic sistentes. This Aphid was introduced into Switzerland, probably in the latter half of the nineteenth century, from the Caucasus, where both *P. orientalis* and *A. nordmannia* are indigenous. The original alternation of food-plants has been observed to take place in Switzerland wherever *P. orientalis* has been introduced, and winged sexuparae also occur on silver fir where this spruce is absent. As, however, the progeny of these forms dies out on the native *P. excelsa* without being able to form galls, the development of *C. nüsslini* is dependent under these circumstances on parthenogenetic secondary cycles, composed either exclusively of generations of sistentes, or alternately of sistentes (at the juncture of the new growth) and progredientes (on young needles). Trees up to 25 years old were found to be attacked, the injury radiating from the crown downwards, and even old trees, the crowns of which were uninfested, were found to have the trunks covered with colonies of *C. nüsslini*. Colonies of this kind, confined exclusively to the stem bark, have not hitherto been observed. In such cases the progrediens

generation is entirely suppressed, and propagation is effected solely through the production of neosistentes. The reinfestation of silver firs in the absence of *P. orientalis* is therefore effected by means of wingless forms, chiefly young larvae, either through active migration or by passive transport. Any winged forms that develop on silver fir needles produce only sexual forms, which must inevitably perish on *Abies*. No exception to this rule was observed in the course of numerous breeding experiments.

The present observations indicated that *C. nüsslini* only causes extensive injury to silver fir where shade is either absent or inadequate. In shady situations the attack is less general and is chiefly confined to the bark of old trees. Injury may be prevented by planting young silver firs in the shade of older trees, such measures as cutting down infested trees or treatment with insecticides being of only secondary importance.

Wille (J.). **Die Rübenblattwanze** *Piesma quadrata* **Fieb.** [The Beet Leaf Bug, *P. quadrata*, Fieb.]—*Monogr. Pflanzenschutz*, no. 2, 116 pp., 39 figs., 65 refs. Berlin, Julius Springer, 1929. Price, paper, *M.* 9.60.

This monograph, which is mainly based on two years' personal investigation and observations of *Piesma quadrata*, Fieb., in the infested area in Anhalt and Silesia, also collates the work of other authors. Much of the information given has already been noticed from individual papers [*R.A.E.*, A, xvi, 1, 591 ; xvii, 582, etc.]. All stages of this Tingid are described, and an account is given of its bionomics and geographical distribution and of the area within which it is injurious. The nature and importance of the leaf-crinkle disease it produces in sugar-beet are discussed, together with the manner in which it is transmitted. Symptoms caused by the feeding of the bugs on other plants are described, and leaf-crinkle is compared with North American curly-top of beet. The control measures that may be employed against the disease and against the insect itself are reviewed.

Gasow (H.). **Die Bekämpfung schädlicher Forstinsekten.** [The Control of injurious Forest Insects.]—*Landw. Ztg. Westfalen u. Lippe*, lxxxv, 1928, p. 635. (Abstract in *Neuheiten PflSch.*, 1929, no. 2, p. 49. Vienna, 1929.)

Applications by means of power sprayers of 5 per cent. lysol killed the eggs of *Tortrix viridana*, L., on oak without causing injury to the buds.

Voelkel (H.). **Methoden zur Prüfung von Pflanzschutzmitteln. II. Mitteilung. Die Bestimmung der Haftfähigkeit von Stäubemitteln.** [Methods for testing Materials for Plant Protection. 2nd Communication. The Determination of the Adhesiveness of Dusts.]—*Arb. biol. Reichsanst.*, xvii, no. 3, pp. 253–272, 6 figs., 8 refs. Berlin, 1929.

An account is given of the various ways in which powdered insecticides may be used. In the case of material intended for employment in cloud form the particles must not adhere to each other, and the material must become readily diffused. Materials applied directly to the plants

under air pressure or with an aeroplane require yet other qualities, particularly that of immediate adhesiveness. Where air pressure is used, the particles are driven on to the foliage by the first blast and become more firmly attached at each subsequent one, but in the case of cloud application the particles settle gradually and are easily blown off by wind. Closer observations made by means of test applications to glass plates showed that particles of talc, which are mostly leaf-shaped, do not lie flat on the surface when the latter is not agitated, but remain upright on edge. When the plate is agitated, however, all these particles fall flat, and their adhesive value is thus greatly enhanced.

A description is given of a series of tests of the adhesiveness of 78 materials intended for application in cloud form, and of the determination of an index of adhesiveness in each case, in which a modification of Görnitz' apparatus [*R.A.E.*, A, xv, 646] was employed. The analyses confirmed the fact pointed out by Borchers [*R.A.E.*, A, xvii, 581] that the adhering material may consist largely of the carrier. Tests of this nature indicate whether the effective poison and the carrier are likely to separate out in practical application. The adhesiveness of the materials tested varied between 75 and 109 as compared with the talc standard. Materials with an adhesiveness of less than 75 are not suitable for application in cloud form. It is doubtful to what extent the adhesiveness of dusts can be increased. It is possible that a dust possessing an ideal degree of adhesiveness might remain in the tree tops when applied to thickly planted growth, leaving the lower parts of the tree uncovered.

ZACHER (F.). **Magnesiumoxyd, ein neues, unschädliches und wirksames Mittel gegen Kornkäfer und andere Vorratsschädlinge.** [Magnesium Oxide, a new, harmless and effective Means of controlling *Calandra granaria* and other Pests of stored Products.]—*Mitt. Ges. Vorratsschutz*, v, no. 4, pp. 49–52, 2 refs. Berlin, July 1929.

Much of this information on experiments with various dusts against pests of stored products is also contained in the paper noticed below [next abstract]. Ten gm. of magnesium oxide placed in a metal box with 2 kg. of wheat containing 100 adults of *Calandra granaria*, L., killed 99 at the end of 5 days, one having escaped.

ZACHER (F.). **Ein neues wirksames Mittel gegen Kornkäfer und andere Vorratsschädlinge.** [A new effective Insecticide against *Calandra granaria* and other Pests of stored Products.]—*NachrBl. deuts. PflSchDienst*, ix, no. 8, pp. 67–68. Berlin, August 1929.

Tests with various dusts, such as copper carbonate and a number of proprietary preparations, used for rendering seed proof against fungi, etc., showed them to be effective against the grain beetle [*Calandra granaria*, L.], but their poisonous nature permits their use only with grain intended for seed. The toxicity of copper salts has been considered to be directly proportional to their solubility, but this is only true when they act as stomach poisons. In the case of pests of stored products the action is purely that of a contact poison, as proved by experiments with the pupae of the Bruchid, *Spermophagus* (*Zabrotes*)

subfasciatus, Boh. All treated pupae died after 4 days ; of the untreated pupae, 60 per cent. produced normal adults. Experiments were then made with various salts of copper, including the carbonate, oxide, sulphate (anhydrous), acetate, and chloride, using *S. subfasciatus*, *C. granaria*, and *Sitodrepa panicea*, L. The times required for a 100 per cent. mortality are shown in a table. *S. subfasciatus* was about equally sensitive to the carbonate, acetate, and chloride, but this was not so with the other beetles, and it seems clear that the effect of copper compounds as contact poisons is in inverse ratio to their solubility, the soluble compounds (acetate, sulphate, chloride) having the weakest action. As metallic copper in the finest division proved inactive, it appears that copper is not the active principle. The experiments were therefore extended to the oxides and carbonates of zinc and magnesium, the same beetles being used, and again satisfactory results, which are tabulated, were obtained. Magnesium oxide, used against *Dermestes murinus*, L., killed all the beetles in 6 days. The action was that of a contact insecticide, because the pupae, as well as the larvae and adults, of *S. fasciatus* were killed. The larvae and adults of the flour moth [*Ephestia kühniella*, Zell.] were also destroyed by magnesium oxide, the adults dying in 3 days and the larvae in 7. This discovery of the insecticidal action of the carbonates and oxides of metals, presumably not confined to the few examined, must have a theoretical and practical value in the protection of stores and plants. The toxicity of the compounds tested differed with the insect. Magnesium oxide was the most effective against *C. granaria* and *S. panicea*, and zinc carbonate against *S. fasciatus*. Of the various dust insecticides, those containing arsenic or fluorine are highly poisonous to man. The metallic compounds dealt with here should therefore prove useful, especially the non-poisonous and cheap magnesium oxide.

Brühl (K.). **Die Buchsbaumgallmücke** *Monarthropalpus buxi* **Labouib. und ihre Bekämpfung.** [The Boxwood Leaf-miner and its Control.] —*Geisenheimer Mitt.*, 1928, pp. 111–113. (Abstract in *Zbl. Bakt.*, (2) lxxviii, no. 16–23, p. 489. Jena, 26th July 1929.)

A serious infestation of *Monarthorpalpus buxi*, Lab. (boxwood leaf-miner), which has hitherto caused no noteworthy damage in Germany, where it was first observed in 1911, is recorded from Bonn in 1927, where almost an entire plantation of box was destroyed. The control measures employed in France and America are briefly discussed [*R.A.E.*, A, xii, 421, etc.], including dusting the previously moistened foliage with flowers of sulphur at the time of oviposition, from mid-May to mid-June, and cutting off infested shoots in January and February.

Arndt (W.). **Schäden an lagernden und an in Gebrauch befindlichen Badeschwämmen.** [Injury to Bath Sponges in Storage and in Use.]—*SitzBer. Ges. naturf. Freunde Berlin*, 1928, no. 8–10, pp. 213–214. Berlin, May 1929.

Niptus hololeucus, Fald., *Dermestes lardarius*, L., and *D. frischi*, Kug., are the only insects known to infest bath sponges.

Illing (—). **Vom Himbeerkäfer und Erdbeerstecher.** [Notes on the Raspberry and Strawberry Weevils.]—*Die kranke Pflanze*, vi, no. 7, pp. 134–135. Dresden, July 1929.

An account is given of an attempt to control insects infesting perennial plants by starvation, as is done by means of crop rotation in the case of those attacking annual ones. *Byturus tomentosus*, F., which had been causing serious injury to raspberry plants in Saxony, was controlled by cutting the plants back to the ground in the autumn of 1924, so that no blossom occurred in the following spring. In 1926 the crop was entirely free from infestation. *Anthonomus rubi*, Hbst., was controlled on strawberry by removing all the blossom in the year following planting, thus leaving the weevils without food or shelter for development.

Rambousek (F.). **Insekten als Krankheitsüberträger.** [Insects as Carriers of Disease.]—*Z. Zuckerind. čsl. Repub.*, 1928–29, pp. 405–409, Prague, 1929. [reprinted in] *Ber. ForschInst. čsl. Zuckerind., 1928–29*, xxxii, pp. 397–401, 2 figs. Prague, 1929.

The injury to plants caused by insects is discussed from a general standpoint, types of injury being described as simple, where the character of the plant remains unaffected, and complex, where agents of disease are transmitted to the plant, within which they develop and spread independently. Insects with biting mouth-parts usually transmit only diseases of vegetable origin, the causal organisms of which have fallen on their bodies and enter the plant through wounds caused by feeding, and these diseases, though generally insect-transmitted, may be produced without their intervention. Transmission of diseases by sucking insects, on the other hand, is associated with deformation of the leaves or other parts of the plant attacked, such as galls. The problems of the transmission of leaf-crinkle, curly-top and mosaic disease of sugar-beet are discussed from the literature. Injury to the foliage of beet caused by thrips and *Bourletiella lutea*, Lubb., which is brought about by the sucking and destruction of the cells, has been found to be of a purely mechanical nature. Although the symptoms produced are exactly similar to those caused by the feeding of Aphids, no disease organisms are present in the affected tissues. Attention is drawn to the structure within the bodies of Aphids, Coccids and other Homoptera termed the pseudovitellus. This structure, which harbours symbiotic saccharomycetes, the importance of which has yet to be determined, lies in the fourth and fifth abdominal segments and is not connected with any other organ. It has been found in sucking insects associated with virus diseases, but the most careful examination has failed to reveal its presence in either thrips or Collembola. It is therefore suggested that the pseudovitellus plays a definite part in the spread of virus diseases.

Sitowski (L.). **Do biologji pasorzytów borecznika (*Lophyrus* Latr.). Cześć II.** [On the Biology of the Parasites of *Diprion*. Pt. ii.] —*Prac. Komis. mat.-prz. Poznansk. Towarz. Prz. Nauk*, Ser. B, v, reprint 8 pp., 10 refs. Posen, 1929.

Continued observations on the parasites of various species of *Diprion* (*Lophyrus*) in Poland [*cf. R.A.E.*, A, xiii, 445] were carried out in

1926–28. About 650,000 cocoons of *D. pini*, L., were collected in a forest near Plotzk on the Vistula for the purpose of breeding *Sturmia inconspicua*, Mg., 77,000 pupae of which were subsequently despatched to America for the control of *Porthetria* (*Lymantria*) *dispar*, L. About 12 per cent. of the cocoons were naturally infested by this Tachinid, and 25 per cent. by *Spilocryptus adustus*, Grav.; the latter was observed for the first time to be parasitised by *Hemiteles areator*, Grav. Of the other parasites reared, *Exenterus marginatorius*, F., infested 20 per cent. of the cocoons, *Pezomachus cursitans*, F., infested 6 per cent., but only attacked the summer generation, and *Monodontomerus dentipes*, Boh., infested 1 per cent. *M. dentipes* has also been bred by the author from cocoons of *D. similis*, Htg., in Pomerania; its other hosts are briefly reviewed from the literature, and it is suggested that it may often act as a hyperparasite. The percentage of the cocoons of *D. pini* attacked by *Microcryptus basizonus*, Grav., *M. sericans*, Grav., and *M. contractus*, Grav., was insignificant. Parasites observed for the first time were *Parabates latungula*, Thoms., infesting cocoons of *D. virens*, Kl., and *Diplostichus janithrix*, Htg., infesting those of *D. pini*. A detailed description is given of the appearance of the latter when parasitised by this Tachinid, which is, however, rare and unimportant. The relative abundance of the different species of parasites varies in different parts of Poland, but their joint activity is of considerable value in controlling serious outbreaks of the sawflies.

Nunberg (M.). **Biologische Beobachtungen über Borkenkäfer.** [Biological Observations on Bark-beetles.]—*Bull. int. Acad. pol. Sci. Lettres*, 1928, no. 3–7 (B, Zool.), pp. 113–128, 1 pl. Kraków, 1929.

This article deals chiefly with the number of yearly generations of 26 bark-beetles recorded from the virgin forest of Bialowies.

Ozols (E.). **Der Erdbeerblattkäfer, *Galerucella tenella* L.**—*Folia zool. hydrobiol.*, i, no. 1, pp. 113–147, 7 figs. Riga, 15th June 1929. (With a Summary in Lettish.)

As result of an outbreak of *Galerucella tenella*, L., on strawberry near Riga in 1924, a study of its bionomics was carried out in 1925. All the stages are described. The overwintered adults appear in the second half of April and at once begin to feed on the stems and the upper surface of the leaves of strawberry, seriously injuring the plants. They are very sluggish and do not fly or migrate to strawberry beds a few yards distant from infested ones. If the leaves are touched, the beetles drop to the ground. Oviposition occurs from early in May till about the middle of July, the eggs being laid singly or in small batches on the stems and upper surface of the leaves. The maximum number of eggs laid in the insectary was 312. The larvae hatch in 21–32 days, and unlike the adults, feed on the lower surface of the leaves. They migrate from plant to plant, but cannot travel any considerable distance. They have also been found severely infesting *Spiraea ulmaria*. The damage they cause to strawberries does not kill the plants, as they grow leaves a second time and may completely recover if no infestation occurs in the following year, but the crop is considerably reduced. The larval stage lasts 22–28 days, and pupation occurs in the soil near the surface. The young adults emerge in about 15 days and feed on strawberry leaves till about the end of August, when they enter the soil to a depth of 2–4 ins. for hibernation; some individuals remain on the plants as late as the middle of September.

The eggs can only be killed by insecticides at very high concentrations, which damage the plants, while the larvae occur at the period of formation and ripening of the berries, when the application of poisons is undesirable. Measures should therefore be directed against the adults [*R.A.E.*, A, xv, 206], a spray of lead arsenate being applied twice at an interval of 10 days, either at the end of April and beginning of May, or end of July and beginning of August.

[Grossheĭm (N.).] **Гроссгейм (Н.). A Note on the Appearance of the first Generation of the Meadow Moth in 1929.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, v, no. 7–8, pp. 328–335, 3 figs., 8 refs. Kharkov, 1929.

The adults of *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., were unusually abundant in May 1929 in the Mleev district of the Kiev Government. Only 20 per cent. of the eggs were laid on economic crops (chiefly carrots and sunflowers), 80 per cent. being deposited on weeds. The number laid was very small in comparison with the numbers of moths on the wing. The behaviour of the larvae was abnormal; in many cases they migrated from the plants on which they had hatched, infesting certain areas and leaving others untouched without any apparent reason, though the maximum damage was done in places sheltered from the wind. In some cases the larvae severely injured onions, cabbage, etc., leaving beet untouched, although at a distance of about half a mile they infested the latter; in other places they defoliated young oaks, apple trees and gooseberry bushes, but neglected the food-plants usually preferred.

The importance of a study of the biology of *L. sticticalis* and of the methods of controlling the first generation in order to prevent an outbreak of the second is emphasised; Russian literature on the subject is briefly reviewed. There exists a difference of opinion on the relative value of barium chloride and Paris green against the larvae. In laboratory experiments Paris green as a dust or as a spray at the rate of 1·3 lb. to 100 gals water killed all the larvae, whereas a 10 per cent. solution of barium chloride killed only 68 per cent. Field and laboratory experiments indicate that barium chloride is effective only when it acts as both a contact and stomach poison. In the insectary only 19 per cent. of the full-grown larvae were killed by feeding on plants sprayed with 10 per cent. barium chloride, whereas 75 per cent. were killed when the spray was applied to both larvae and plants. The larvae feed under a web, which protects them from a contact insecticide, but when migrating, they are exposed. This possibly accounts for the difference in the opinion of various authors on the value of barium chloride, as satisfactory results were probably obtained when the poison was applied at the moment of the migration of the larvae.

[Shchegolev (V. N.).] **Щеголев (В. Н.). The Lepidoptera of the Genus *Heliothis* as Insect Pests of Oil Plants and Medicinal Cultures and Fodder Plants in the North Caucasian Region.** [*In Russian.*]—*Byull. Sev.-Kavkazek. Kraev. sel.-khoz. opuitn. Sta.*, no. 282, 48 pp., 16 figs., 30 refs. Rostov-on-Don, 1929.

This is a detailed account of observations carried out by the author in 1927–28 on the biology and ecology of *Heliothis dipsacea*, L., *H.*

scutosa, Schiff., and *H. peltigera*, Schiff., in the northern Caucasus, where these moths have two generations a year, or in the case of *H. peltigera* sometimes three, hibernation occurring in the pupal stage.

Some of the information concerning *H. dipsacea* has already been noticed [*R.A.E.*, A, xvii, 263, etc.] ; the adults of the first generation are on the wing throughout May, and those of the second about the middle of July. The damage caused by the larvae to lucerne and oil-producing plants [*loc. cit.*] is discussed at length. *H. scutosa* is of considerably less importance, as the larvae usually feed on the leaves of *Artemisia absinthium* (wormwood), *Xanthium* and other weeds, and only migrate to cultivated plants if they are very abundant. Parasites reared from both species were *Paniscus opaculus*, Thoms., *Exetastes robustus*, Grav., *Microplitis mediana*, Ruthe, and *Echinomyia praeceps*, Mg. ; *H. dipsacea* was also attacked by *Tachina fallax*, Mg., *Eulimneria xanthostoma*, Grav., *E. rufifemur*, Thoms., *Ischnus truncator*, F., *Amicroplus collaris*, Spin., *Cnephalia hebes*, Fall., *Voria trepida*, Mg., and *Tachina larvarum*, L. ; and *H. scutosa* by *Apanteles* sp.

H. peltigera is an important pest of safflower (*Carthamus tinctorius*), from which oil and dye are produced, sage (*Salvia officinalis*), mint, *Atropa belladonna*, *Hyoscyamus albus*, *Calendula officinalis* and a number of other cultivated oil-producing and medicinal plants. The larvae were heavily parasitised, especially in June and July, and in the laboratory none survived, the parasites reared being *Omorgus solitarius*, Brischke, *O.* (*Anilastus*) *mutabilis*, Holmgr., *Rhogas* sp., *Apanteles* sp., *Microbracon* (*Bracon*) *piger*, Wesm., *Eulimneria rufifemur*, and *Echinomyia praeceps*.

A brief review is given of the Russian literature on *H. obsoleta*, F., which was very scarce during these observations. The characters differentiating the eggs, larvae and pupae of these four species of *Heliothis* are discussed in detail, and a key to the pupae is given. A list of the food-plants of the larvae in Russia is appended.

[Bogdanov-Kat'kov (N. N.).] **Богданов-Катьков (Н. Н.). The Cabbage Fly.** [*In Russian.*]—8vo, 2nd edn., 35 pp., 21 figs., 1 pl., 13 pp. refs. Leningrad, P. P. Soĭkin, 1929. Price 40 *kop.*

This is a popular account of the bionomics and control of *Phorbia* (*Hylemia*) *brassicae*, Bch., based partly on the literature and partly on observations carried out in the Leningrad Government in 1922–28. All stages of the fly are described, the adult being compared with those of *P.* (*H.*) *floralis*, Fall., and *P.* (*Chortophila*) *cilicrura*, Rond. In the Leningrad Government, there is one generation and a partial second in the year, hibernation occurring in the pupal stage. The remedial measures advocated are the destruction of cruciferous weeds ; washing the roots of cabbage seedlings prior to transplanting ; stimulation of growth by chemical manures ; raising the earth in small hills round each plant to encourage the formation of new roots ; raking off the soil from each seedling three to four times at intervals of 8 to 10 days to remove any eggs, fresh soil being replaced each time ; deep spring and autumn ploughing to destroy the pupae ; and watering infested plants

with emulsions of carbolic acid or quassia at intervals of 4–5 days, or with a solution of mercury bichloride, 1 : 1,000. A bibliography of the Russian and foreign literature on this fly is appended.

[Yakhontov (V.).] **Яхонтов (В.). The Cotton Cicada.** [*In Russian.*] —*Khlopkovoe Delo*, viii, no. 7, pp. 730–739, 13 figs., 4 refs. Moscow, July 1929.

An account is given of observations on *Cicadatra ochreata*, Mel., which has caused considerable damage to cotton in Bokhara during the last two or three years. The distribution of this Cicadid in the region is discussed, and all its stages are described. The only injury to cotton is caused by the oviposition punctures, since the larvae and adults feed on other plants. At the end of May and beginning of June the nymphs emerge from the soil and, after climbing the stems of plants to a height of about 8–12 ins., transform into adults. These do not migrate, though if disturbed they may fly for a distance of 1–2 miles. They have been observed feeding on the sap of young twigs of poplars and mulberry trees, but probably also feed on herbaceous plants, as they may be abundant in places where there are no trees or shrubs. Oviposition begins about a fortnight after the emergence of the adults and lasts till about the second half of July. As many as 52 deep punctures sometimes occur on the stem of a cotton plant, probably made by several females ; single individuals were observed making 11–14 punctures each at a time. They are placed along the stem or petioles at intervals of 1·5–3 mm. The female lays 10–15 eggs in each of the egg chambers, which are very deep and extend as far as the centre of the stem or traverse it entirely, causing the plant to wither quickly. Even under very favourable conditions the cotton is usually so much weakened that it cannot produce a normal crop. Oviposition occurs also on a number of other thick-stemmed plants, a list of which is given, including vines (which were severely damaged in 1928 in one district), potatoes, melons, thin branches of pear and mulberry, *Alhagi camelorum*, *Sophora alopecuroides* and *Glycyrrhiza glabra*, the last three plants being preferred to cotton.

The adults die between the end of June and the second half of July, and the eggs hatch at the end of July or beginning of August. The young larvae at once drop to the ground and penetrate into the soil ; they do not, however, remain in cotton fields where there are no weeds, but migrate to waste lands where these occur. Both the larvae and nymphs feed on the roots of herbaceous plants, preferring those of *Alhagi camelorum*, *Cynodon dactylon* and *Aeluropus littoralis*. They may be found at any time of the year, and on the basis of observations on the periodicity of the mass occurrence of the adults, the author considers it probable that the life-cycle covers a period of four years.

The adults of the Asilid, *Satanas gigas*, Ev., are predacious on those of *C. ochreata*, and an unidentified Chalcid was found feeding externally on the eggs, of which several were attacked by the same larva.

C. querula, Pall., has also been observed ovipositing in the stems of cotton in Bokhara, but it only occurs in comparatively small numbers. Plants of *Alhagi camelorum*, which both species prefer to all others for oviposition, should be cut down earlier than this is usually done, in order to prevent the eggs from hatching, as they do not develop once the plant is cut.

Fey (K. Y.). **The Problems of Rice Borers and Locusts in China.** [*In Chinese.*]—*J. Agric. Ass. China,* no. 60, pp. 7–17. Shanghai, February 1928.

A brief account is given of the problems connected with the study and control of the rice borers [*Schoenobius bipunctifer,* Wlk., and *Chilo simplex,* Butl.], and locusts [*Locusta migratoria,* L., etc.], which have been serious pests in central and south-eastern China in recent years.

Nakayama (S.). **Studies on the natural Enemies of** *Pyrausta nubilalis,* **Huebner.**—*Ann. Agric. Expt. Sta. Chosen,* iv, no. 3, pp. 173–175. Suigen, Korea, June 1929.

The Braconid, *Macrocentrus gifuensis,* Ashm., is a parasite of the larvae of *Pyrausta nubilalis,* Hb., in Korea. Descriptions of both male and female are given.

Nakayama (S.). **On the Distribution of the Rice Borer,** *Chilo simplex,* **Butl., in Korea.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.,* iv, pp. 375–376. Tokyo, 1929.

Chilo simplex, Butl., occurs throughout Korea and prefers varieties of rice that have thick stalks.

Niijima (Y.). **On the Damage to** *Picea* **caused by Beetles of the Family Scolytidae in Hokkaido.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.,* iv, pp. 376–381. Tokyo, 1929.

During recent years in Hokkaido, *Picea jezoensis* and *P. glehni* have been considerably damaged and sometimes killed by the Scolytids, *Ips japonicus,* Niij., *Polygraphus jezoensis,* Niij., *Crypturgus tuberosus,* Niij., *Cryphalus piceae,* Ratz., *C. abietis,* Ratz., and *Ips* (*Pityogenes*) *chalcographus,* L. They do not attack young healthy trees, but infest the less vigorous ones that are often more than 250 years old. *I. japonicus,* is particularly injurious to *Picea jezoensis* and also occurs in large numbers in Sakhalin in forests damaged by *Dendrolimus.* The female lays about 30 eggs, which hatch in about 8 days. Most of the beetles are found in the middle of the trunk, but they can also bore along the whole length of it. There are two generations a year. *Polygraphus jezoensis* chiefly attacks the apical parts of the trees.

Okajima (G.). **Notes on the Distribution of** *Scotinophara lurida,* **a Pest of the Rice Plant.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.,* iv, pp. 382–402. Tokyo, 1929.

The Pentatomid, *Scotinophara lurida,* Burm., is distributed throughout the Japanese Empire, with the exception of Hokkaido, Sakhalin and Korea, and its occurrence was recorded as long ago as 1803. In Japan it has one generation a year, but is said to have three in Formosa, hibernation taking place in the adult stage. The adults are active on cloudy days and in the evening or early part of the night. The food-plants include many natural orders, but Gramineae are chiefly attacked, rice being preferred. The distribution of this bug

is limited by temperature; the average yearly temperature of the areas in which it occurs is above 12° C. [53·6° F.], and it prefers moist places.

KATSUMATA (K.). **The Life-history, Habits and Methods of Control of** *Scotinophara* (*Podops*) *lurida*, **Burm.** [*In Japanese.*]—66 pp., 3 pls. Ishikawa, Agric. Expt. Sta., March 1929.

This is a detailed account of the bionomics of the Pentatomid, *Scotinophara* (*Podops*) *lurida*, Burm., on rice in Japan [*R.A.E.*, A, xiv, 201, 236]. Some varieties of rice are more seriously attacked than others. The adults become active in April or May when the temperature reaches about 15° C. [59° F.] and fly from the middle of June onwards, when the temperature is above 20° C. [68° F.]. Migration to rice-fields, where older plants are preferred, usually takes place in the evening.

MARUMO (N.). *Nymphula vittalis*, **Bremer.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, i, no. 1, pp. 45–46. Tokyo, August 1929.

The larvae of *Nymphula vittalis*, Bremer, caused serious damage to rice in the Aichi prefecture in 1928 by cutting the leaves for making nests, thereby killing the plants. An illustrated description of the larva is given.

TAKAHASHI (S.). **A Cerambycid injurious to Nettle-hemp** (*Boehmeria frutescens*) **in the Nagasaki Prefecture and the Future of the Cultivation of this Plant.** [*In Japanese.*]—*J. Plant Prot.*, xvi, no. 8, pp. 452–456. Tokyo, August 1929.

A Cerambycid has caused considerable injury to this fibre plant during recent years in the Nagasaki Prefecture, having been probably imported from China. The beetles are common in May.

MATSUDA (M.). **Studies on** *Chrysomphalus aonidum* **L. in Formosa.** [*In Japanese.*]—*Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 39, 79 pp., 5 pls. Taihoku, April 1929.

Chrysomphalus ficus, Ashm. (*aonidum*, auct.) is widely distributed in the low-lying areas of Formosa, attacking a wide range of plants, of which *Citrus* is preferred, this Coccid being among its most important pests. All stages are present at all times, there being 5 or 6 generations a year. The females are mostly found on the lower surface of the leaves and begin to oviposit 16–37 days after emergence, each laying about 50–70 eggs during its life at the rate of 1–8 a day. They only mate once soon after the last moult when the scales are small and not completely formed; sometimes they produce eggs parthenogenetically, these giving rise to both males and females. The males live 2–6 days, whereas the females may live up to 27 days in summer and 54 in winter. The egg period varies according to the temperature from 26 hours at 28° C. [82·4° F.] to 4 days at 17 or 18° C. [62·6 or 64·4° F.]; in winter the eggs only hatch on rather warm days. The first instar larvae can live 25–46 hours without food, this stage lasting 8 days at 27° C. [80·6° F.] and 32 days at 16·5° C. [61° F.]; the second instar lasts 14 and 51 days at the same temperatures.

The females have only two larval instars, but the males have two additional pupal ones.

Aphelinus chrysomphali, Mercet, and *Coccophagus hawaiiensis*, Timb., are parasitic on this Coccid, the former being the more common and infesting up to 5·4 per cent. It lays 1–4 eggs in one host, the egg, larval, and pupal stages lasting 3, 13, and 7–12 days respectively. A fungus, *Microcera fujikuroi*, also infests *C. ficus*, sometimes causing a mortality of 50 per cent.

MATSUDA (M.). **Studies on** *Chrysomphalus aonidum*, **L. Supplementary Notes. I.** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 5, pp. 159–161. Gifu, 15th May 1929.

Thirty species of evergreen plants are recorded as food-plants of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) for the first time from Japan.

NISHIYA (J.). **On** *Ledra duditura*, **Wlk.** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 5, pp. 148–154. Gifu, 15th May 1929.

The Jassid, *Ledra duditura*, Wlk., which has one generation a year in Japan, inserts its eggs in the branches of pear trees in November. The larvae hatch in June, the adults appearing in October.

DUPONT (P. R.). **Entomological and Mycological Notes.**—*Ann. Rep. Dept. Agric. Seychelles 1928*, pp. 5–6. Victoria, Seychelles, 1929.

Scale insects infesting coconut, chiefly *Pinnaspis buxi*, Bch., and *Ischnaspis longirostris*, Sign. (*filiformis*, Dougl.), are spreading rapidly, although there are indications that they are being increasingly controlled by parasitic fungi. Plantations handicapped by poor soil conditions suffer more than others. *Coccus elongatus*, Sign., is recorded on Barbados [? cherry = *Malpighia glabra*] and Bois noir [*Albizzia lebbek*] and *Aulacaspis pentagona*, Targ., on papaya [*Carica papaya*] and mulberry. The experimental mulberry fields have been a failure owing to the attacks of *A. pentagona*, and though a small black Coccinellid preys on this scale to a slight extent, it is suggested that the introduction of other natural enemies from abroad will be necessary if the culture of mulberry for the rearing of silkworms is to be undertaken.

MAHDIHASSAN (S.). **Schmetterlingsraupen als Feinde der Lackschildläuse.** [Lepidopterous Larvae as Enemies of the Lac Coccids.]—*Natur u. Mus.*, lix, no. 8, pp. 394–400, 10 figs. Frankfort on Main, August 1929.

This is a brief account of the bionomics of some of the Lepidoptera, the larvae of which prey on lac-producing Coccids in India [*cf. R.A.E.*, A, xiv, 138].

ANDREWS (E. A.). **A Tiger Beetle** (*Neocollyris crassicornis*, **Dejean**) **boring into Tea Stems in N.E. India.**—*Quart. J. Ind. Tea Ass.*, 1929, pt. 2, pp. 45–50. Calcutta, 1929.

Injury to tea by a Cicindelid, *Neocollyris crassicornis*, Dejean, was first observed locally in north east India in March 1928, and similar attacks

occurred in March 1929. Little has been observed on its biology. The larva lives in the pith of the stem, in a burrow about an inch long with a hole at one end through which it protrudes its head to catch insects as they crawl along the stem. In some stems the larvae were present in large numbers. Pupation probably takes place in the burrow, the adult remaining in it for some time before it finally emerges in April or May. There is apparently only one generation a year.

It is suggested that the local migration of *N. crassicornis* to tea was due to conditions in its former habitat becoming unfavourable. It cannot apparently burrow into hard wood; consequently only young wood left on the bushes at the time of pruning or unpruned bushes are liable to attack. The injury caused by the borings is severe enough to give a serious set-back to young plants; but the insects may also be to some extent beneficial in that they probably feed on Aphids, ants, etc. The larva and adult are described.

RAMAKRISHNA AYYAR (T. V.). **Notes on some Indian Lepidoptera with Abnormal Habits.**—*J. Bombay Nat. Hist. Soc.*, xxxiii, no. 3, pp. 668–675, 20 refs. Bombay, May 1929.

An account is given of the observations of the author and other workers in different parts of India on the association of various Lepidoptera with other insects, with a view to summarising the knowledge on the subject of the entomophilous or entomophagous moths and butterflies so far recorded from India. The following Lepidoptera are recorded as feeding on Coccids: *Spalgius epius*, West., *Eublemma coccidiphaga*, Hmps., *E. vinotincta*, Hmps., *E. amabilis*, Moore, *E. scitula*, Rmbr., *Pammena isocampta*, Meyr., *Anatrachyntis falcatella*, St., *Holcocera* (*Hypatima*) *pulverea*, Meyr., and *Euzophera cocciphaga*, Hmps.

Euzophera cocciphaga is parasitic on *Aspidoproctus xyliae*, Gr. (MS.). One or more larvae or pupae are found in an infested scale, their presence being indicated by the silk and frass with which the caterpillar attaches the scale firmly to the plant surface, apparently to prevent the escape of the Coccid embryos, since it seems to feed on both embryos and eggs. The moth lays numerous eggs singly on the dorsal region of the Coccid, and the young larvae on hatching enter the scales by making a passage through the ventral region. Pupation takes place in a cocoon within the host, and the pupal period in captivity in November lasted from 7 to 10 days.

DE JONG (J. K.). **Enkele resultaten van het onderzoek naar de biologie van de tabaksluis, *Myzus persicae* Sulzer.** [Some Results of an Investigation on the Biology of the Tobacco Aphid, *M. persicae*.]. —*Bull. Deli Proefst.*, no. 28, 36 pp., 29 refs. Medan, June 1929. (With a Summary in English.)

Breeding experiments were made from June 1928 to March 1929 in order to study the biology of *Myzus persicae*, Sulz., under the tropical conditions of Deli, Sumatra, where it has been a pest of tobacco for many years. In most cases the Aphids were kept on leaves of *Ipomoea triloba* placed in Petri dishes. The humidity was maintained at about 100 per cent. by wads of cotton-wool soaked in water, which also served to check withering of the leaves, from which the Aphids

were transferred daily to fresh ones. Males have not yet been observed in Deli. In favourable weather *M. persicae* can occur in abundance during the period that tobacco is in the field (January–June) and do much harm. Its food-plant during the remainder of the year is unknown. It occurs in three colour groups. These are morphologically identical, even in the winged individuals, but the red form has often a longer average life and more progeny than the green one, these differences being so marked and constant that the two groups are considered to be distinct races. This is probably also the case with the yellow group, but the data available are as yet insufficient.

M. persicae is markedly polyphagous, and a list of its food-plants is given. When the Aphids are very numerous on tobacco, they may also be found on the weeds growing beneath or near it, but this does not imply that they are food-plants. Satisfactory reproduction was not obtained on *Portulaca oleracea*, and probably not on *Physalis angulata*, but *Ipomoea* as a food-plant gave as good results as young tobacco.

The Aphids seemed little affected by differences in relative humidity. Drops of water on tobacco leaves, such as those attached to the hairs in wet weather, sometimes cause death by drowning, especially in the case of young individuals. This is probably the reason why outbreaks sometimes decrease or cease after rain. The average daily temperature of 25° C. [77° F.] in Deli is about the optimum for *M. persicae*. In the field this temperature is exceeded during the day for a more or less prolonged period according to altitude. Such an increased temperature, even for a few hours daily, checks reproduction, its effect being most marked if one of the larval instars is affected, when it may result in a shortening of life and a smaller number of progeny. Under the climatic conditions of the higher plantations in Deli, *M. persicae* matures and begins reproducing in 7 days. The average number of young is about 50, and the average length of life 16 days.

BARNES (H. F.). **Two Gall Midges (Cecidomyidae) found in Stored Products.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 119–122, 4 figs. London, August 1929.

Descriptions are given of both sexes of *Lestodiplosis raphani*, sp. n., reared from larvae and pupae in stored radish seed in Denmark and Germany, and of *Arthrocnodax farinicola*, sp. n., from flour at Naples. The larvae of both species were thought to be feeding on mites infesting the seed and flour respectively.

BODKIN (G. F.). **The Locust Invasion of Palestine during 1928.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 123–139, 3 pls., 3 figs., 7 refs. London, August 1929.

Since 1865, invasions of *Schistocerca gregaria*, Forsk., in Palestine have occurred at regular intervals of 12–13 years, that of 1915 being the most devastating. Notes are given on the losses caused by some of these invasions.

In 1928, the first recorded swarms passed over Jericho on 25th March. The bulletins issued by the Department of Agriculture in Jerusalem as to the position of swarms, egg laying, hatching, etc., from 24th April to 21st May are quoted, and a map of the 1928 invasion is included. In the Jericho area oviposition took place principally in irrigated land. It began on 27th April and continued intermittently

for some weeks. The eggs hatched in 15–16 days, shade temperatures at the time being as high as 116° F. In cooler areas they took slightly over a month to hatch.

The organisation of the 1928 campaign is described, some reference being made to measures employed in 1915, and special stress is laid on the necessity of predicting the outbreaks for the purpose of providing an ample supply of apparatus, baits etc. Flame-throwers, which are described and figured, were used with great success, as it proved possible to exterminate swarms prior to egg laying and thus avoid further expenditure on egg destruction. The cost of a charge, which can burn for ten minutes continuously, is 1s.; in practice, however, the flame is usually applied in short bursts.

The method of destroying the hoppers by means of pits with barriers of zinc sheets, which was also employed in the campaign, is explained in detail.

SMITH (H. S.). **Multiple Parasitism: Its Relation to the Control of Insect Pests.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 141–149, 1 fig., 6 refs. London, August 1929.

The term "multiple parasitism" has been suggested by the author [*R.A.E.*, A, v, 16] to designate that type of parasitism in which the same individual host insect is inhabited simultaneously by the young of two or more different species of primary parasites. In the case of solitary parasites, such competition generally results in the death of one or the other parasite. Often, because of specific fitness, one species is always dominant when two meet in competition.

In the practical work of introducing entomophagous insects into new habitats to aid in the control of insect pests, this condition is often encountered, and it is maintained by some entomologists, as for example, Pemberton, Willard and Bissell, that such competition results in a lower mortality of the host than would occur if a single species were present. Since the usual practice is to introduce all available primary parasites, the point is very important.

The characteristics of parasites in relation to competition within the host are designated as intrinsic. When the survival of parasites living in the same host is not determined by their specific peculiarities (such as length and strength of mandibles, aggressiveness, etc.) but simply by chance (as, for example, the moment of arrival in the host) parasites are said to be intrinsically equal; otherwise one species is intrinsically superior and the other intrinsically inferior. The characteristics of parasites in relation to the environment are designated as extrinsic. Two species of parasites occupying the same number of "ecological niches" are extrinsically equal. If one species occupies a larger number of ecological niches than another, it is extrinsically superior and its competitior extrinsically inferior.

Under this classification, various types of multiple parasitism may exist. The competing species may be both intrinsically and extrinsically equal, equal in either one of these respects but unequal in the other, or unequal in both. In the last case the species that is intrinsically superior may be either superior or inferior extrinsically. All these types of multiple parasitism are discussed by the author, who maintains that in no case is it disadvantageous to import both of the competing species, while in the majority of cases it is positively advantageous to do so. He does not consider that the data put

forward by Pemberton, Willard and Bissell constitute sufficient proof of their contention that *Opius humilis*, Silv., which is extrinsically superior, but intrinsically inferior to *Diachasma tryoni*, Cam., would have accomplished more alone in controlling the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Hawaii than in conjunction with the latter parasite. He believes that on theoretical grounds as well as on the data so far available, the policy of introducing all available primary parasites of injurious insects is justified, especially since sudden environmental changes, which might be detrimental to any one species, are not likely to affect all of a group of species in the same way.

Imms (A. D.). **Some Methods of Technique applicable to Entomology.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 165–171, 5 refs. London, August 1929.

Various methods of technique that have been used by the author for a number of years but do not appear to be generally known are described, the subjects discussed including mounting media, staining, decolourising chitin, dissecting and preserving fluids, storage of spirit material, and methods of rearing insects.

Krishna Ayyar (P. N.). **A new Pest of Rice in South India.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 173–178, 1 fig. London, August 1929.

An account is given of an outbreak of Pentatomid bugs on rice in Madras in July 1926. The species concerned were *Tetroda histeroides*, F., and *Scotinophara lurida*, Burm., but as each bunch of plants attacked harboured an average of 15–20 of the former and only 1–4 of the latter, *S. lurida* was of minor importance. *T. histeroides* has been known as a minor pest of rice for a number of years, and as breeding has not been observed on any other plant, the author considers that the sudden increase in its numbers and importance is due to the practice of growing five crops of rice in two years (so that there is an almost continuous food-supply for the bug), which has recently superseded the old system of growing two crops a year with a break of nearly two months between each. The infested fields present a characteristic yellowish-brown, dried-up appearance, owing to the fact that the bugs suck the juices of the outer leaf-sheaths and subsequently the inner leaves, which turn yellow and dry up, until ultimately the plants die and the bugs fly to other fields. The eggs are usually laid in two contiguous rows on the lower surface of the overhanging distal halves of the lower leaves in batches of 4–31, the latter number being the largest deposited by a single female. All stages of the bug are described. The egg stage lasts 5–7 days, and the total period from egg to adult varied from 49 to 62 days. Under laboratory conditions the adults can live for at least two months, but may live longer in the field.

The only natural enemies observed were two egg parasites, one being a Chalcid, possibly *Anastatus colemani*, Crwfd., and the other possibly a Braconid. Attempts were made to rear the parasites in the insectary to study the possibility of breeding them for liberation in affected areas. They fed freely on sugar solution and oviposited in fresh eggs of *Tetroda*. The development of the Braconid occupied 15 days and that

of the Chalcid 12–13, except in three cases when it took only 8. The Chalcids were more numerous and hardy, and the possibility of breeding them in numbers is certainly greater.

Various control measures, such as hand-picking, the use of light traps, dusting with calcium cyanide, etc., were tried without success. Spraying with oil emulsions was more effective and is recommended for further trial. The bunds were too small and low to allow of the complete submergence of the plants, but a partial flooding caused the bugs to crawl up the plants, and coolies were then employed to dislodge them, sweep them up with brooms and destroy them by immersion in kerosene and water. As the cost of this method was inconsiderable, it soon became popular among the cultivators and was extensively employed.

HOLDAWAY (F. G.). **Confirmatory Evidence of the Validity of the Species *Pectinophora scutigera*, Holdaway (Queensland Pink Bollworm), from a Study of the Genitalia.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 179–185, 8 figs., 6 refs. London, August 1929.

A study of the genitalia of both sexes of *Platyedra* (*Pectinophora*) *scutigera*, Hold. (Queensland pink bollworm), originally named from the immature stages, has confirmed the validity of the species. Details of a comparative study of the genitalia of this species and of *Platyedra gossypiella*, Saund., are given and figured. The author considers that both species should be referred to the genus *Pectinophora*.

SALT (G.). *Castniomera humboldti* **(Boisduval), a Pest of Bananas.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 187–193, 1 pl., 16 refs. London, August 1929.

A study carried out in Colombia of the Castniid, *Castniomera humboldti*, Boisd., the larva of which has been reported for a number of years as causing occasional damage to the pseudostems of bananas in northern South America, has led to the discovery that not only is it much more abundant than has been supposed, but that the damage it causes has a serious effect on the production of bananas. It would appear that the young larva feeds on the tender tissues of the young suckers (which may be actually killed), then passes across to the base of an older plant, enters the pseudostem at about ground level, makes a vertical and usually superficial burrow to a height of one or even two metres, and subsequently returns, when nearly full-grown, to bore extensively in the tougher tissues of the rhizome. The economic significance of the attack is somewhat obscure, young suckers may be killed, pseudostems may be weakened, growth may be retarded, and occasionally even a well-grown plant may be destroyed, but as a rule the apparent effect of the boring is slight ; there is, however, a definite reduction in the size of the bunches of fruit. A comparison of bunches from infested and uninfested plants showed an average reduction from 8·5 to 6·1 hands per bunch, and as bunches of less than 7 hands are not normally exported (and 62·3 per cent. of the bunches from infested plants were of this class), the economic significance of the pest is obvious.

Descriptions of the larvae and pupae are given, together with a few notes on the colour of the adults. The duration of the larval stage is not known, but collected larvae lived more than a month before pupating. On reaching maturity, the larva constructs a cocoon from fibres of the

banana plant cemented and hardened by a secretion, in which it spends a pre-pupal period of 4–6 days and a pupal period of 26–35 days. The larvae are readily reared in small sections of banana pseudostem by placing them in a small pit in the side and closing the cavity with a piece of the tissue removed. Although the moths are usually seen on the wing on bright days between 8.30 and 11 in the morning, they prefer shade to sunlight. They appear to be somewhat attracted by ripe and rotting banana fruits and frequently settle on bananas left in the field.

C. humboldti appears to be confined to Colombia and Venezuela. Records of injury of economic importance caused by other Castniids in various parts of the world are briefly reviewed.

Box (H. E.). **On the Identity of the common Dipterous Parasite of the Larva of *Diatraea saccharalis*, Fabr., in the Northern Provinces of Argentina.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 199–200, 5 refs. London, August 1929.

The synonymy of *Paratheresia signifera*, Towns., the common parasite of the larvae of *Diatraea saccharalis*, F., in Argentina, is discussed, and it is now clear that *Sarcophaga diatraeae*, Brèthes [*R.A.E.*, A, xvi, 159] is a synonym of it. *P. signifera* must not be confused with *Oxysarcodexia peltata*, Aldrich, which is a true Sarcophagid. It apparently attacks the new species of *Diatraea* recently discovered [*R.A.E.*, A, xvii, 303] to at least the same degree as it attacks *D. saccharalis*. In Tucumán the Diapriid, *Aulatopria tucumana*, Brèthes, has been bred from 1 per cent. of the puparia of *P. signifera*. In this locality another Dexiid parasite of *D. saccharalis* occurs to a small extent.

Marshall (G. A. K.). **New Curculionidae (Col.) from Cacao and Camphor.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 201–204, 2 figs. London, August 1929.

The new weevils described are *Dermatodes camphorae* from Java on *Cinnamomum camphora*, and *Ischnotrachelus theobromae* from Fernando Po, *Tylodes vellericollis*, from Brazil, and *Conotrachelus curvecostatus*, from Brazil and French Guiana, all on cacao foliage.

Wilkinson (D. S.). **New Species and Host Records of Braconidae.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 205–208, 1 fig. London, August 1929.

The new species described are *Rhaconotus oryzae* from borers, possibly *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), hibernating in rice stubble from India, *Microplitis radicalis* from an unknown host, possibly the larva of a Sphingid moth, from China, and *Dinocampus mylloceri* from adults of *Mylloceras undecimpustulatus* var. *maculosus*, Desb., from India. The last-named species is the Braconid erroneously identified as *Loxocephalus* sp. [*R.A.E.*, A, xvii, 542]. *Ipobracon* (*Iphiaulax*) *peronatus*, Cam., recorded from Trinidad, is considered by Myers to be associated with the Lamiid, *Stirastoma depressum*, L., infesting cacao logs. *Microdus* (*Bassus*) *aciculatus*, Brues, is recorded from *Earias biplaga*, Wlk., and *E. insulana*, Boisd. (cotton bollworms) from Uganda.

Whitfield (F. G. S.). **The Sudan Millet Bug,** *Agonoscelis versicolor,* **F.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 209–224, 1 pl., 16 figs., 9 refs. London, August 1929.

Every few years the Pentatomid, *Agonoscelis versicolor,* F., causes serious losses of millet (*Sorghum* spp.), which is the main food crop in the northern Sudan. Although the bug is widely distributed throughout Africa, it is apparently only in the Sudan that it occurs as a serious pest. In the years when the attack is not general, small areas are injured, and in others it is often the cause of local famine. In earlier accounts, the bug was erroneously recorded as *A. puberula*, Stål. The adult insects (and occasionally the nymphs of the final instar) feed on the grains of millet when they are in the soft stage prior to the final ripening, and once the grains are punctured and the bug has fed, if only for a few minutes, they become atrophied and all further development ceases. Descriptions are given of the external appearance and morphology of the insect.

During August, after a certain amount of rain has fallen, the adult bugs leave their resting quarters in trees, hedges, etc., and fly in search of food. They usually select lucerne (*Medicago sativa*) and a variety of indigenous weeds, on which they oviposit during the last week in August. Eggs are also sometimes found on the ground or on débris underneath the plants. They hatch in 3–5 days, and the total life-cycle from egg to adult varies from 18 to 29 days. The younger nymphs are more or less gregarious and show a preference for the flower buds and fruit capsules of weeds, whereas the more mature ones tend to wander from plant to plant and are generally found feeding on the drying capsules and seeds. On reaching maturity the adults feed for a few days on the weeds before flying off to attack the ripening heads of millet. About the end of October the bugs migrate to trees and bushes, collect in clusters and enter a resting stage that occupies not less than nine months, throughout which time they do not feed and remain more or less inactive. Their behaviour during this stage is described in detail.

In the Blue Nile Province the rains are preceded by isolated storms, but though the bugs make brief flights, they return to their resting places, and do not finally leave them until the end of July, when they move in swarms and begin to feed and pair. Most of the females entering the resting stage are immature, and no further development of the ovaries takes place until the bugs are about to leave the trees, maturity being attained about ten days later. Adults from the earliest laid eggs, however, probably develop quickly and breed immediately they are mature. If they survive, they probably lay a second lot of eggs in the following year. As a rule there is only one generation a year.

The methods and media found to be most satisfactory for mounting, staining and fixing specimens in the northern Sudan are described.

Wolcott (G. N.). **The Status of Economic Entomology in Peru.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 225–231. London, August 1929.

A detailed account is given of the climate and crops in the various regions of Peru, with notes on the insect pests and their control. Cotton and sugar-cane grown in the coastal valleys are attacked by various pests; among those that have not already been noticed [*R.A.E.*, A, xiv, 545; xvi, 251; xvii, 100] are *Marasmius trapezalis*, Guen., which occasionally damages young sugar-cane, and *Golofa*

aegeon, L., the male adults of which sometimes chew into young cane shoots and shred the leaves, though the actual damage is slight. Oranges were extensively grown in this region in past years, but the accidental introduction of *Lepidosaphes beckii*, Newm., and *Selenaspidus* (*Pseudaonidia*) *articulatus*, Morg., killed many of the older trees. *Anastrepha fraterculus*, Wied., is the most important pest of deciduous fruit, which is grown in small quantities. In the area of tropical rain forest, insect pests are scarce, but cane injured by rats is often attacked by termites and two species of *Metamasius*, and a variety of the leaf-cutting ant, *Atta sexdens*, L., is a serious pest of *Citrus* and avocado, often defoliating a tree overnight.

MAULIK (S.). **Injurious Hispinae from the Solomon Islands.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 233–239, 6 figs. London, August 1929.

Descriptions are given of *Pharangispa purpureipennis*, gen. et sp. n. (including a brief description of the larva) on ginger, *Aulostyrax nuciferae*, gen. et sp. n., on unopened leaflets of coconut, and *Promecotheca alpiniae*, sp. n., on *Alpinia* sp., all from the Solomon Islands.

TRÄGÅRDH (I.). **Methods of investigating the Fauna of Tree-stumps.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 245–250, 5 figs., 5 refs. London, August 1929.

An account is given of the methods used by the author in investigating the life-history of *Hylobius abietis*, L. (pine weevil) in Sweden, including measurements of the width of the head-capsule and the length of the body of the larva. By using traps it was determined that in central Sweden about 70 per cent. of the larvae are full-grown in the autumn and hibernate as larvae in their pupal chambers. In the last half of July and August in the following year, some of the larvae pupate, and they emerge as adults in the autumn, though many hibernate a second time as larvae or pupae. On account of the low temperatures in the autumn, it is very unlikely that the newly emerged beetles finish the feeding that is necessary for pairing and oviposition. Observations on the infestation in stumps from trees cut at different times of the year showed that there is normally a period of about four months, April to July, when the trees may be cut and the stumps left in the ground without any great risk of the weevils increasing to any considerable extent, but it is, unfortunately, impossible to make use of this fact by altering the usual time of cutting the trees, which is in winter. It is, however, suggested that when small felled areas in which breeding has occurred are to be enlarged, a time should be chosen that is as unsuitable as possible for the increase of the weevil and for injury to the young trees. When stumps are left in the ground, the weevils, though sexually immature, are attracted by their odour and feed on young trees in the vicinity before ovipositing.

It was also found that the beetles greatly preferred the stumps in clearings to those in the wood. This difference in the density of infestation was particularly marked in the case of spruce forests, doubtless because these are denser than pine forests and the differences between the temperature of the air and the temperature and humidity of the soil in the felled areas and in the forests are therefore greater. This observation was confirmed by counting the number of larvae. In stumps of pine in clearings the average number of larvae was 44,

whereas in the wood it was 16. The corresponding figures in spruce stumps were 19·5 and 0. This fact provides another reason for abandoning the practice of making large clearings and extensive plantings in favour of thinning and opening up small areas for re-planting.

JARVIS (E.). **Some Notes on the Economy of Cockchafer Beetles.**—*Bull. Div. Ent. Bur. Sug. Expt. Stas.*, no. 20, 49 pp., 6 pls., 3 figs. Brisbane, 1929.

This bulletin is a collection of notes on the Lamellicorn beetles that attack sugar-cane in Queensland published in the *Queensland Agricultural Journal* and noticed from time to time in this *Review*. Notes are also included on some insect enemies of other cane pests [*R.A.E.*, A, xii, 518].

Gilbert and Ellice Islands Colony: Plants Ordinance no. 5 of 1929.—3 pp. Suva, Fiji, 19th June 1929.

This Ordinance forbids the introduction, without permission, into the Gilbert and Ellice Islands of plants from any place from which their importation has not been prohibited. Samoa is the only place from which the importation of plants is absolutely prohibited. All plants introduced are liable to inspection. Provision is made for regulating the introduction of the personal effects of travellers, etc.

Modification of Nursery Stock, Plant and Seed Quarantine Regulations. Amendment no. 1 of Revised Rules and Regulations supplemental to Notice of Quarantine no. 37.—*U.S. Dept. Agric., P.Q.C.A.*, Q.37, 1 p. Washington, D.C., 29th July 1929.

The effect of this amendment to regulations already noticed [*R.A.E.*, A, xv, 390; xvi, 562] is to prohibit the importation into the United States of Mahaleb cherry [*Prunus mahaleb*] and Myrobalan plum [*P. divaricata*] under permit or otherwise after 30th June 1931.

[**Administrative Instructions concerning Mediterranean Fruit Fly Quarantine.**]—*U.S. Dept. Agric.; P.Q.C.A.*, multigraph, 2 pp. Washington, D.C., 28th June & 12th August 1929.

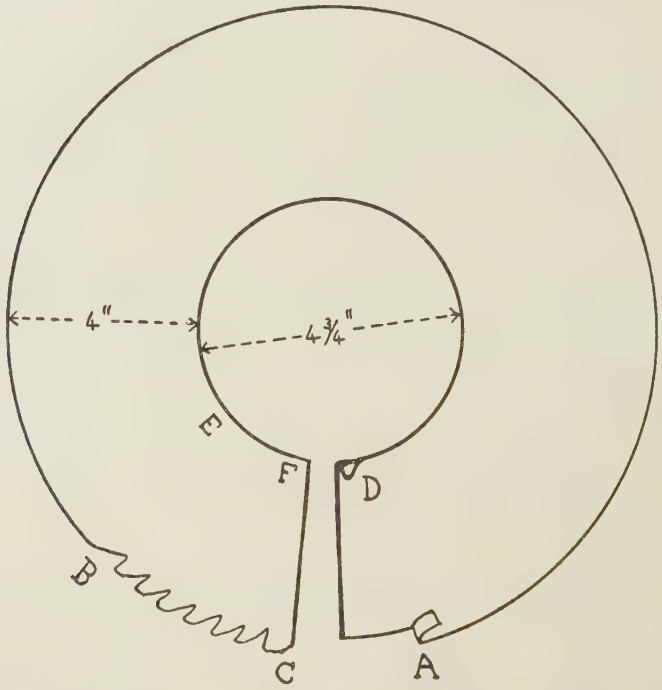
In view of the fact that neither cowpeas nor any other kind of beans, except lima beans [*Phaseolus lunatus*] and broad beans, have been recorded as susceptible to infestation by *Ceratitis capitata*, Wied. (Mediterranean fruit-fly), or have become infested as a result of experimental work, cowpeas and all other kinds of beans, except lima and broad beans, are removed from the list of vegetables, the movement and cultivation of which is restricted in Florida under quarantine no. 68 [*R.A.E.*, A, xvii, 508].

Flintoff (A.). **Curculio Beetle** (*Otiorrhynchus cribricollis*).—*J. Dept. Agric. W. Aust.*, (2) vi, no. 2, pp. 333–339, 5 figs. Perth, W.A., June 1929.

The weevil, *Otiorrhynchus cribricollis*, Gyll., has recently caused considerable damage to fruit trees in parts of Western Australia, where it has been known for more than 20 years.

The adults shelter during the day just beneath the surface of the ground and feed at night from November to April, doing much damage to the leaves, petioles, bark of fruit spurs and laterals. The fruit is also liable to be attacked when in clusters, and the beetles may remain in the clusters during the day.

Strips, one inch wide, of sheepskin with wool 6 inches long, fastened round the trunks of the trees, will catch the weevils, which cannot fly, as they crawl up from the ground. The skin side of the band must not come in direct contact with the tree, as the oil in the skin will cause damage. Young non-bearing trees may be protected by spraying with 1 lb. lead arsenate to 8 gals. water. Carbon bisulphide against the weevils in the soil may prove effective, but has not been thoroughly tested. Adjustable metal bands have also been used successfully to prevent the weevils from ascending the trees. The band or collar



is cut out of a flat sheet of light galvanised iron as indicated in the figure. The hook A engages with one of the notches B–C to enable a stock size of band to be adjusted to trunks varying 2 inches in circumference, a lip D engaging with the inner edge E–F. The band is so adjusted round the trunk that it slopes downwards at an angle of 45°, the upper edge fitting tightly against a strip of sheepskin or other material round the bark. It is suggested that a bait consisting of

twigs dipped in a poison solution and placed at the foot of the trees should be used in conjunction with these bands. One grower has obtained good results by keeping poultry in an infested orchard, the weevils in the ground being easily found by the birds.

Mediterranean Fruit Fly Quarantine. Notice of Quarantine no. 68 (revised) with Revised Rules and Regulations supplemental to Notice of Quarantine no. 68.—*U.S. Dept. Agric., P.Q.C.A.*, 11 pp., 1 map. Washington, D.C., 1929.

This general revision of the quarantine against *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in Florida [*R.A.E.*, A, xvii, 508] became effective on 1st September 1929, from which date all previous regulations and revisions were superseded.

The term " eradication area " is used to designate any area in which an eradication programme is being carried out and includes the infested and protective zones. The regulations concerning the destruction of host fruits, etc., during the host-free period, in these areas, the extent of which is shown in a map, are similar to those previously in force in protective zones. Spraying and clean-up measures must be carried out, as prescribed, on all properties within eradication areas during the ripening and harvesting period, before the beginning of the host-free period (1st April for fruit, 15th June for vegetables). Outside eradication areas, the harvesting and clean-up of commercial citrus plantings shall be completed throughout an infested State before 1st April, and no movement from such areas will be permitted after that date, except of citrus fruit in cold storage.

When an infestation is discovered, if it is general within the infested area, all host fruits and vegetables within the area must be destroyed ; if the infestation is confined to a limited part of the infested area, the utilisation or movement of host fruits, etc., in or from other parts of the area may be permitted if no risk is incurred thereby.

Sterilisation by heating or refrigeration is now considered a satisfactory treatment for fruit for eliminating the risk of carrying the fruit-fly, and when the methods are perfected, sterilised fruit and vegetables from any part of an infested State will be allowed to be moved, under permit, to any other State. In the meantime sterilised fruit from an eradication area, unsterilised tomatos and egg-plants from any part of the State, and unsterilised fruit, peppers [*Capsicum*], broad beans and lima beans [*Phaseolus lunatus*] produced outside eradication areas, may be moved into any part of the United States, except the 18 southern and western States and Porto Rico ; peppers, lima beans and broad beans, produced within eradication areas, and unsterilised fruit produced in eradication areas (except infested areas), may be moved to the District of Columbia, Maryland and Pennsylvania, and States north and east thereof.

Cotton bolls may not be moved interstate from an infested State ; cotton seed produced within eradication areas may not be moved to any place outside such areas, and cotton seed produced in an infested State outside eradication areas may not be moved interstate without permit.

In the definition of host fruits and vegetables, strawberries are now included in the list of fruits not susceptible to infestation, and gourds, pumpkins and squashes are omitted from the list of susceptible vegetables.

Administrative Instructions. Sterilisation of Citrus Fruits under Mediterranean Fruit Fly Regulations.— *U.S. Dept. Agric., P.Q.C.A.*, [Circular no.] 246, multigraph, 2 pp. Washington, D.C., September 1929.

Authorisation is given for the sterilisation of citrus fruit in Florida by the following method : the fruit is cooled until the centre reaches a temperature of 28° F., at which it is kept for 5 hours ; the temperature of the fruit is then raised to 30° F., at which it is maintained for the next 5 days.

The movement in refrigerators of citrus fruit graded and packed in standard commercial containers from Florida to designated cold storage plants in certain States for sterilisation is also authorised under permit.

Rules and Regulations of the State Plant Board of Florida concerning Mediterranean Fruit Fly Quarantines, etc., as adopted September 16, 1929.—*Mon. Bull. Pl. Bd. Florida*, xiv, no. 3, pp. 47–61. Gainesville, Fla., September 1929.

The State regulations on account of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) [*R.A.E.*, A, xvii, 509] are further revised to bring them into line with the Federal regulations noticed above.

Hume (H. H.). **The Mediterranean Fruit Fly Situation.**—*Mon. Bull. Pl. Bd. Florida*, xiv, no. 2, pp. 29–42. Gainesville, Fla., August 1929.

In this popular address, delivered on 13th August 1929, the author discusses the status of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida, and describes the measures carried out in that State in order to exterminate it, mention being also made of its importance in various other parts of the world.

Soon after the discovery of the fly in Florida, on 6th April 1929, it was found in one grove that every fruit in a crop of grapefruit amounting to 4,000 boxes was infested. When the campaign against *C. capitata* was begun, it was found by blowing calcium cyanide into the tops of trees and collecting the fruit-flies thus killed on sheets spread on the ground, that in one 40 acre grove, containing 70 trees to the acre, there was an average of about 500 adults to each tree. The trees were then sprayed with a poison bait, and the number of fruit-flies in certain trees was again ascertained by using calcium cyanide ; in no case were there more than 48 flies in one tree.

The bait-spray used in Florida consists of brown sugar or molasses, or both, lead arsenate and water ; it is applied to the tops of the trees, and the amount used, which does not usually exceed two-thirds U.S. pint to a large tree, is not sufficient for the arsenic to cause premature ripening of the fruit when the applications are continued over a period of weeks. A new type of spray gun has been devised, by means of which a measured quantity of spray is applied rapidly and accurately.

Guavas, Surinam cherries [*Eugenia uniflora*], and in some parts of the State peaches and pears, are of little or no economic importance, but they are preferred host fruits of *C. capitata* ; hitherto the fruit from these has been destroyed, and in some cases the trees have been cut back, but it will be necessary for these and other economically unimportant fruit trees to be eradicated.

By the beginning of August 1929, the area of Florida in which *C. capitata* was known or considered likely to occur was approximately 7,000,000 acres, but the control measures had been so successful that flies were extremely difficult to find, and the author believes that complete extermination of the pest in Florida can be achieved.

Woglum (R. S.), La Follette (J. R.) & Landon (W. E.). **Handbook of Citrus Insect Control for 1929. The Mediterranean Fruit Fly.**—*Bull. California Fruit Gr. Exch.*, no. 6, 48 pp., 6 pls. Los Angeles, Cal., July 1929.

This report records the results obtained with various proprietary insecticides against insect pests of *Citrus* in southern California in the season 1928–29, with notes by E. A. McGregor on the treatments given in central California. A table showing the characteristics of 26 proprietary oil sprays used on *Citrus* is appended ; it indicates their gravity, viscosity, unsulphonated residue, mineral oil content, type of emulsifier, compatibility with lime-sulphur, etc.

In view of the presence of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in Florida, and the menace it presents to the California fruit industry, an account is given of its life-history and habits. By 1st June, 563,000 boxes of fruit had been condemned and destroyed in Florida. If the fly were to be introduced into California, it would find great acreages of fully matured *Citrus* and of deciduous fruits available during the season of its greatest activity, namely, July to October. In connection with inspection work, notes are given on the insects, chiefly Dipterous larvae, that may be found in California attacking decayed *Citrus* fruits either on the trees or on the ground.

Jacquet (J.) & Bonnamour (S.). **Note sur les moeurs et l'alimentation de *Carpophilus hemipterus* L. (Col. Nitidulidae) et de sa larve.**—*Bull. Soc. ent. Fr.*, 1929, no. 14, pp. 223–224. Paris, 1929.

Larvae, pupae and adults of the Nitidulid, *Carpophilus hemipterus*, L., have previously been recorded in the refuse from winepresses, left in the open air and warm with fermentation, and it was thought that the larvae might possibly feed on the moulds produced or on larvae of *Drosophila*. The authors, having noticed this species in dried figs, and also in melon refuse in a garden, reared it on dried figs for four consecutive months. It was noticed that when any of the figs became mouldy the larvae left them for fresh ones. It is probable that they live entirely on fruits, especially those in the process of decomposition, and particularly figs. *C. hemipterus* is rare in the Lyons region ; it is probably imported from time to time in dried figs and is able to feed and develop, but the infestations are few and far between.

Papers noticed by Title only.

Ginsburg (J. M.). **A Comparison between complete and incomplete Digestion of sprayed Apple Foliage in determining Arsenic by the Gutzeit Method.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 155–156. New Brunswick, N.J., 1929. [Abridged : *cf. R.A.E.*, A, xvi, 675.]

Ginsburg (J. M.). **An Apparatus for collecting measured Areas of sprayed Foliage for Chemical Analyses.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 156–157, 1 fig. New Brunswick, N.J., 1929. [Brief description only, *cf. R.A.E.*, A, xvi, 682.]

JARVIS (H.). **Feeding Habits of some Queensland Birds.**—*Queensland Agric. J.*, xxxii, pt. 1, pp. 8–12, 1 pl. Brisbane, 1st July 1929.

VEITCH (R.). **Pests of Deciduous Fruits.**—*Queensland Agric. J.*, xxxii, pt. 1, pp. 13–27, 4 pls. Brisbane, 1st July 1929. [Extract, see *R.A.E.*, A, xvii, 458.]

VEITCH (R.). **Pests of Citrus.**—*Queensland Agric. J.*, xxxii, pt. 2, pp. 136–150, 6 pls. Brisbane, 1st August 1929. [Extract, see *R.A.E.*, A, xvii, 458.]

MURAMATSU (S.). **List of Insects injurious to Rice collected by Light Traps near Suigen, Korea. I.** [*In Japanese.*]—*J. Plant Prot.*, xvi, pp. 277–285. Tokyo, 1929.

TAKAHASHI (S.). **The Need for a Study of the Distribution of Insect Pests in Japan.** [*In Japanese.*]—*J. Plant. Prot.*, xvi, pp. 285–288. Tokyo, 1929.

MARUTA (S.). **Biological Studies on the Woolly Apple Aphis** [*Eriosoma lanigerum*, Hausm.]. [*In Japanese.*]—*Ann. Agric. Expt. Sta. Chosen*, iv, no. 2, pp. 99–123. Suigen, Korea, April 1929. [*Cf. R.A.E.*, A, xvii, 237.]

SHINJI (O.). **Three new Species of Aphids from Morioka.** [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xl, no. 474, pp. 153–155. Tokyo, 1928. (Abstract in *Jap. J. Zool.*, ii, no. 3, p. (105). Tokyo, 1929.)

PACK (H. J.) & KNOWLTON (G. F.). **A few Match Brush Aphids from Utah.**—*Canad. Ent.*, lxi, no. 9, pp. 199–204, 5 figs. Orillia, Ont., September 1929.

MAHDIHASSAN (S.). **Specific Symbiotes of a few Indian Scale-insects.**—*Zbl. Bakt.* (2), lxxviii, no. 8–15, pp. 254–259, 7 figs., 13 refs. Jena, 6th July 1929.

MAHDIHASSAN (S.). **The First Stage Larva of Lac Insects.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 241–243, 2 figs., 4 refs. London, August 1929.

FLETCHER (T. B.). **A List of the Generic Names used for Micro-Lepidoptera.**—*Mem. Dept. Agric. India*, Ent. Ser., xi, pp. ix+ 244. Calcutta, June 1929.

MUNRO (H. K.). **Additional Trypetid Material in the Collection of the South African Museum (Trypetidae, Diptera).**—*Ann. S. Afr. Mus.*, xxix, pt. 1, pp. 1–39, 1 pl. Cape Town, August 1929.

CHAMPION (H. G.). **Note on the Mating Habits of** *Rhyssa persuasoria* **Linn.**—*Ent. Mon. Mag.*, lxv, no. 785, pp. 231–232. London, October 1929.

RAMBOUSEK (F.). **Ueber die Felddrahtwürmer. I. Systematischer Teil.** [On the Field Wireworms. I. Systematic Part.]—*Z. Zuckerind čsl. Repub.*, 1927–28, pp. 393–402, 19 figs., Prague, 1928. [reprinted in] *Ber. ForschInst. čsl. Zuckerind., 1928–29*, xxxii, pp. 1–10, 19 figs., 1 ref. Prague, 1929. [See *R.A.E.*, A, xvii, 208.]

PFEFFER (A.). **Ueber eine neue korsische** *Pityophthorus*-**Art. (Col. Ipidae.)** [*P. angeri*, sp. n., on *Pinus poiretiana* in Corsica.]—*Sbornik ent. Oddĕl. národ. Mus. Praze*, v, pp. 111–113, 1 fig. Prague, 1927. (In Czech with a Summary in German.)

EGGERS (H.). **Zwei neue** *Blastophagus*-**Arten (Ipidae, Col.).** [Two new Species of *Myelophilus* (*Blastophagus*).]—*Ent. Bl.*, xxv, no. 2, pp. 103–104. Berlin, 30th June 1929.

Cooley (R. A.) & others. **Work done by the Entomological Department.**—*34th Ann. Rep. Montana Agric. Expt. Sta. 1926–27*, pp. 90–96. Bozeman, Mta. [1928.]

Although grasshoppers [? *Melanoplus*] oviposit from July until late autumn, most of the eggs hatch during a period of a few days in the following spring. Experiments showed that eggs that had never been exposed to low temperatures developed most rapidly at 80° F., and more slowly at 90 and 100°, so that eggs laid in midsummer when the soil temperatures are above 90 or 100° are in a more nearly similar condition to those laid in autumn than they would have been if development were directly proportional to temperature. If the eggs are kept at low temperatures (about 32° F.) for several months, their rate of development is greatly accelerated when they are returned to temperatures at which they normally develop. These factors bring about the complete hatching within a few days in spring of eggs laid over a period of several months in the previous summer. This tends to confine the larval period to the spring, when green succulent food is available, and during a normal year practically all individuals reach maturity at the beginning of the summer, thus allowing the maximum time for oviposition. Exposure for 16 hours at 22° F. killed all the eggs, but the same exposure at higher temperatures did not result in any appreciable injury. Such low temperatures rarely occur at a depth of two inches in the soil, where the eggs are usually placed, but if they are brought to the surface by harrowing, it is possible that many would be killed during a hard winter.

The time necessary to kill grasshoppers submerged in water at different constant temperatures varied from 3 hours at 100° F. to 84 hours at 32° F., indicating that they can remain alive under water for several days in cold weather, whereas flooding with irrigation water on a warm day might kill them within a few hours.

A study of the weather conditions favourable for outbreaks of the pale western cutworm [*Porosagrotis orthogonia*, Morr.] in Montana [*R.A.E.*, A, xiv, 124 ; xvii, 229] has shown that when the total rainfall for May, June and July is below 4 inches, the moth will increase in the following spring, whereas if the rainfall is above 5 inches it will decrease. Two successive dry years are usually necessary to bring on a severe outbreak, whereas one dry season may be followed by local outbreaks. A study of the weather records shows that such a season may be expected about once in 5 or 6 years in the region in and near the Rocky Mountain Divide and once in 7 or 8 years in eastern Montana.

During 1926, *Euxoa messoria*, Harr., was unusually abundant, but it decreased in 1927 without causing any severe damage. An outbreak of the army cutworm [*Chorizagrotis auxiliaris*, Grote] occurred in the spring of 1926, the larvae originating mainly in abandoned fields of wild mustard. The eggs are laid chiefly on the southerly slopes of such fields. An undescribed parasite proved valuable in checking the outbreak. In one locality where an outbreak of *C. auxiliaris* occurred in 1927, a fairly large number of the larvae proved to be those of *Feltia venerabilis arida*, Ckll., which has not previously been regarded as of economic importance. An account is given of the campaign against the mormon cricket [*Anabrus simplex*, Hald.] [*R.A.E.*, A, xvii, 182, 479].

(7630) Wt P4/3520 1,700 12/29 H & Sp Gp 52

PARKER (J. R.) & MABEE (W. B.). **Montana Insect Pests for 1927 and 1928. The Twenty-second Report of the State Entomologist of Montana.**—*Bull. Montana Agric. Expt. Sta.*, no. 216, 23 pp., 5 figs. Bozeman, Mta., December 1928.

An account is given of the Sphegid, *Palmodes laeviventris*, Cress., and the Scelionid, *Sparaison pilosum*, Ashm., which attack the mormon cricket [*Anabrus simplex*, Hald.] in Montana [*R.A.E.*, A, xvii, 479]. During the autumn of 1927 the Sphegids were very abundant, their holes being evident every few inches over areas of 40 acres or more. After consuming the entire contents of the cricket's body, the parasite pupates in a tough cocoon and emerges late in the following summer (July) in time to attack the newly emerged crickets. Neither of the parasites developed in large numbers until most of the control work had been completed, and the destruction of the crickets effected by the campaign reduced their numbers considerably. If no control measures had been employed, the parasites would undoubtedly have destroyed a large proportion of the crickets during the next few years.

Barathra configurata, Wlk., appeared for the first time in large numbers in Montana during the late summer and autumn of 1928. Lucerne was chiefly attacked, though beets and cabbage were also injured. The damage done was slight, but under favourable conditions an outbreak may occur in 1929.

A map is given showing the distribution of *Eutettix tenella*, Baker (sugar-beet leafhopper) in Montana during 1928. *Niptus hololeucus*, Fald., which occurs as a general household and stored-product pest throughout Europe, is recorded for the first time from a house in Montana. A list is given of the insects that have been reported as causing damage during 1927 and 1928.

CHILDS (L.). **The Relation of Woolly Apple Aphis to Perennial Canker Infection with other Notes on the Disease.**—*Bull. Oregon Agric. Expt. Sta.*, no. 243, 31 pp., 11 figs., 5 refs. Corvallis, Ore., May 1929.

A detailed account is given of experiments carried out from 1925 to 1928 on perennial canker, caused by the fungus, *Gloeosporium perennans*, which is the most serious disease of apple trees in the Hood River Valley (Oregon) and adjacent valleys. The fungus is a wound parasite, apparently incapable of entering uninjured tissue, and is not truly perennial, new annual infections extending the cankers when conditions are favourable. It is closely associated with *Eriosoma lanigerum*, Hausm. [*R.A.E.*, A, xvi, 203], and in an examination of old cankers and pruning wounds in 1925, all infected calluses showed evidence of infestation by *E. lanigerum*, whereas no such evidence was discovered on those that were free from infection.

It appears that the extent to which Aphid-infested (galled) calluses split and the disease spreads depends upon the severity of the winter. In the summer and autumn of 1925 many cankers and calluses were free from Aphids. As a result of the mild winter that followed, a minimum of 20° F. being recorded, practically no serious canker infection had taken place by the spring of 1926. During June, no infected spot was found on 235 calluses that were free from Aphids, whereas 75, or 60 per cent., of the infested ones showed slight infection. Infestation by Aphids became severe where dead bark containing the fungus was not removed from the cankers. The following winter

was much colder, a minimum temperature of 15° F. being registered late in January. Of 51 untreated calluses that apparently remained uninfested by *E. lanigerum*, 7 developed infection, but it is possible that Aphid infestation was overlooked on these. Of those on which the Aphid was observed, 89·2 per cent. became infected. No infection occurred on 24 that were regularly treated with 40 per cent. nicotine sulphate.

In July 1926 it was found that calluses treated a year previously with various paints and wound dressings were in most cases more heavily infested by *E. lanigerum* than the untreated ones, the paint having become separated from the wood and thus providing a suitable shelter for the Aphid. A second application of these materials, however, gave protection for the remainder of the year, the best results in controlling both Aphid and fungus being obtained with a paint containing resin, fish-oil and copper sulphate. Infestation by *E. lanigerum* late in the season usually results in more serious canker infections, and it is therefore not advisable to apply paint before July.

Pruning wounds made in winter have in certain years been followed by infection by canker. Little or no infection has occurred in cuts made after mid-February, callus growth being less vigorous on cuts made in early winter. Almost all pruning wounds are potential canker centres, however, as they are eventually attacked by *E. lanigerum*. Certain varieties of apples exhibit a definite resistance to perennial canker, though some of them are severely infested by *Eriosoma*.

The spread of the disease can only be satisfactorily prevented by the control of the Aphid. Diseased areas should be cut out during July and August, and the cut surfaces carefully covered with a thick coat of suitable paint 2–3 weeks later, the painting being repeated annually. In addition, a spray of 40 per cent. nicotine sulphate, 1 : 1,000, to which casein spreader is added at the rate of 2 lb. to 100 U.S. gals., should be used.

G. perennans also attacks the fruit of apple and sometimes pear (perennial canker is rare on pear trees), causing it to rot in storage. Serious infection is associated with late harvesting and rainy weather. Bordeaux mixture (4 : 4 : 50) applied with the last spray against codling moth [*Cydia pomonella*, L.] in late August or September appears to be of definite value in reducing infection.

DA MATTA (A.). **Coleobroca da seringueira** (*Platypus mattai*). [The Hevea Borer, *P. mattai*.]—*Bol. Minist. Agric. Ind. Comm.*, xviii (1), no. 4, pp. 495–498. Rio de Janeiro, April 1929.

Platypus mattai, described by Brèthes in 1920 [*Rev. Chil. Hist. nat.*, xxiii, p. 16] from Brazil without a record of the food-plant, is here stated to bore in the trunks of *Hevea brasiliensis*.

WOLCOTT (G. N.). **Los insectos de los árboles Cítricos en el Perú.** [Pests of *Citrus* in Peru.]—*La Vida agric.*, vi, no. 66, pp. 447–449. Lima, 1st June 1929.

Coccids attacking *Citrus* in Peru, in order of importance, are *Lepidosaphes beckii*, Newm., *Selenaspidus* (*Pseudaonidia*) *articulatus*, Morg., *Coccus hesperidum*, L., which is not abundant, and *Saissetia oleae*, Bern., recorded from the Cañete Valley only. *L. beckii* is confined to *Citrus*, whereas *S. articulatus* has other food-plants.

McClelland (T. B.) & Tucker (C. M.). **Green Scale, *Coccus viridis*, a new Pest in Coffee and Citrus.**—*Agric. Notes Porto Rico Agric. Expt. Sta., Mayaguez*, no. 48, 2 pp. mimeographed. San Juan, P.R., July 1929.

Serious damage to coffee in Porto Rico, especially during the latter part of the dry season, has recently been caused by *Coccus viridis*, Green (green scale), which also occurs on *Citrus*, guava, etc., in various parts of the island. Coffee plants exposed to the sun and dry weather are particularly infested, as these conditions apparently check the activities of the fungus, *Cephalosporium lecanii*, which sometimes greatly reduces the numbers of the scale. In wet weather, spraying the upper branches with water containing spores of the fungus is recommended. The spray is prepared by scraping off dead scales infested with *C. lecanii* into water, which is then violently shaken in order to dislodge the spores and strained if necessary. In dry weather, when it is useless to attempt to spread the fungus, an oil emulsion spray should be applied. Particular attention should be paid to coffee plants in nurseries, as those attacked may not only be useless for planting but may also spread the infestation.

A brief description of this Coccid is given, with notes on its geographical distribution and the nature of the damage it causes.

Headlee (T. J.). **Report of the Department of Entomology.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 125–189, 1 pl., 4 figs. New Brunswick, N.J., 1929.

A list of the insect pests recorded in New Jersey during 1927–28 is given, with notes on some of the most important. *Porthetria dispar*, L. (gipsy moth) is now rare in the State, but the area of heavy infestation by *Popillia japonica*, Newm. (Japanese beetle) has continued to spread, although the centre of the old infested area is clearer during the past two years. An extremely heavy infestation of *Aphis pomi*, DeG. (green apple aphis) in the summer of 1927 resulted in the breeding of large numbers of Coccinellids, which survived the winter; it was significant that although the spring and early summer of 1928 was very favourable for the development of Aphids, they made no headway on ornamentals, fruit or vegetables. The largest and most widely distributed emergence of *Tibicen septemdecim*, L. (periodical cicada) that has been known in New Jersey occurred, but little economic damage was done because in the last seventeen years very few new orchards have been planted on old woodland sites. *Epilachna corrupta*, Muls. (Mexican bean beetle) has been recorded for the first time from New Jersey, in Cape May County, though it was expected that the beetle would not be able to live in numbers on the Atlantic coastal plain but would be confined to the elevated north-west of the State. It may be that the beetle has now reached so far north that the temperatures on the Atlantic coast do not inhibit its existence. *Zeuzera pyrina*, L. (leopard moth) is causing increasing injury to apple orchards and threatens, unless something is done, to become the most important apple borer in New Jersey; no satisfactory method of control is known for it.

In view of a recent study of the thermal constant for emergence of the codling moth [*Cydia pomonella*, L.] [*R.A.E.*, A, xvii, 62] indicating that the thermal constant can be used for the practical timing of sprays, 39 temperature stations were established in different

parts of the State, and curves of effective day-degrees of temperature have been constructed and applied to the thermal constants as a means of determining when spray applications should be made. The accuracy of this method was demonstrated by comparison with records of codling moth emergence boxes in two orchards. A detailed account of a heavy infestation in 1927 and of the methods of dealing with it has already been noticed [xvii, 79]. After such an infestation, a large number of larvae must succeed in surviving the winter, and numbers of adults will emerge in the spring. The question of where these moths emerge from is an important one, and, recognising that the rough barked trunk and branches of the apple tree would probably provide the source of infestation, a study was made of trunk treatments for killing the overwintering larvae. Pineole soluble, which is one of the fractions obtained by destructive distillation of pine stumps, roots and branches, treated with caustic soda to make it miscible in water, was found to be effective, and on trees of 10 in. diameter at the base, one U.S. quart of pineole soluble was sufficient to kill all the overwintering larvae. The treatments were made in late March and early April, and several months later the trees still showed no sign of injury. Tests were made with white oil, that is, petroleum oil of the spindle-lubricating type from which practically all of the unsaturated hydrocarbons had been removed, applied instead of the sprays in the ordinary schedule, and also with a pyrethrum extract impregnation of white oil, but neither was very successful and both seemed to cause considerable dropping of fruit. During 1927 and 1928, the pyrethrum sodium oleate mixture that has proved so successful as a contact spray for *P. japonica* [*R.A.E.*, A, xvi, 82] proved lethal to the squash bug [*Anasa tristis*, DeG.], the striped cucumber beetle [*Diabrotica vittata*, Say] and the asparagus beetle [*Crioceris asparagi*, L.]. For the last named, the optimum strength of the mixture is considerably lower. Against the pepper maggot [*Spilographa electa*, Say] coating the pepper plants [*Capsicum*] with a spray of 3 lb. powdered lead arsenate to 50 U.S. gals. water, or with a dust of lead arsenate and hydrated lime, soon cleared off the flies, whether by killing or repelling them has not yet been determined.

Against wireworms, granular calcium cyanide was applied to the soil in late May and early June at the rate of 0·1 oz. per sq. ft., by a special machine that introduces it into the plough furrow and covers it at once with a furrow slice. An examination to a depth of 2 ft. after the treatment showed 85 per cent. or more of the wireworms killed, and vegetable crops grown on the treated areas during the next three years have remained practically untouched by wireworms, although adjacent areas showed heavy infestation. The method is, however, too expensive for general use.

DRIGGERS (B. F.). **Oriental Peach Moth Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 145–154. New Brunswick, N.J., 1929.

In laboratory tests, which are described, eight different sprays or combinations of sprays were used against the oriental peach moth [*Cydia molesta*, Busck]. Volck oil, at 1 per cent. and 1½ per cent. actual oil, nicotine sulphate, and a white oil extract of pyrethrum proved the most effective in killing the eggs and young larvae. Nicotine sulphate alone was much more effective in killing eggs in

the black spot stage and newly hatched larvae than with the addition of resin fish-oil soap. The results with the pyrethrum extract were sufficiently promising to warrant further tests. In testing dusts against the eggs and young larvae, a ground nicotine dust containing 1 per cent. nicotine and evolving nicotine slowly was chosen, and several others were made by mixing nicotine sulphate and various carriers in a ball mill. The 1 per cent. nicotine dust was the most effective, the results being much better when the infested twigs were dusted while wet.

Previous studies had shown that a high percentage of the eggs are killed when hit with a white oil emulsion of 1 per cent. or more. A peach orchard was therefore sprayed with Volck oil emulsion, 1½ per cent. A count of infested twigs afterwards showed an average of 3 and 3·4 per cent. injured twigs on trees sprayed with Volck and nicotine sulphate respectively, the number of infested twigs always increasing in proportion to their proximity to a mixed apple and peach orchard that remained unsprayed, and in which the infestation was three times as great as on the sprayed one.

The larvae of the first and second generations attack chiefly the succulent twigs, but from late July onwards the twigs are hard and the fruit is increasingly attacked. Tests were therefore made with several insecticides against the third generation eggs and larvae, but neither Volck, ground tobacco dust, nor nicotine sulphate was sufficiently successful to warrant more extensive tests. A number of dormant season sprays were tried on cocoons on sections of peach tree trunks in cages. At a time when the larvae had probably pupated, 1 : 10 and 1 : 20 dilutions of miscible pine-tar oil (pineole soluble) in which was dissolved paradichlorobenzene at the rate of 1 lb. to 1 U.S. quart of oil only slightly reduced the percentage of emergence. Of various chemicals dissolved in pineole soluble and diluted with water tested on overwintering larvae, paranitrochlorobenzene proved much more effective than paratoluidine or paradichlorobenzene. Even under the thorough conditions of the experiments, however, 9·7 was the lowest percentage of emergence, and for the sprays to be effective in the field the experiments should have shown nearly 100 per cent. mortality. It has been proved that practically all the larvae wintering in rubbish on the ground can be destroyed by ploughing and disking. Experiments showed, however, that 14 per cent. of the overwintering larvae remained on some part of the tree.

GINSBURG (J. M.). **Investigations of Dusts, Spreaders, Stickers, and Diluents for spraying and dusting Mixtures. Arsenical Injury, Correctives, and Adhesion of Spray Mixtures to Foliage.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 154–155. New Brunswick, N.J., 1929.

A brief summary is given of work carried out from 1925 to 1927, much of which has already been noticed [*R.A.E.*, A, xvi, 558, etc.]. Experiments were carried out with several organic compounds and chemicals as correctives for preventing injury to fruit trees by sprays containing acid lead arsenate ($PbHAsO_4$). Those that exhibited properties of eliminating soluble arsenic from solution from spray mixtures containing acid lead arsenate were chosen for field experiments. Peach and apple trees were sprayed with arsenical spray mixtures containing various quantities of these chemicals. The

conclusions drawn from the results are as follows: Of all the chemicals tested, zinc oxide proved the most capable of eliminating soluble arsenic from solution. Zinc oxide proved by itself more toxic to peach and apple foliage than $PbHAsO_4$ and could, therefore, not be used as an arsenical corrective. Arsenical mixtures containing aluminium oxide, aluminium palmitate, calcium silicate, stannic oxide, charcoal and powdered skimmed milk produced arsenical injury on peach after the first spray application. Arsenical mixtures containing ferric oxide or an excess of hydrated lime did not produce injury on apple foliage and only slight injury on peach after the third spray application. The spray mixture containing ferric oxide as a corrective exhibited remarkable adhesion to peach and apple foliage. Chemical analyses of sprayed leaves have shown that considerably more arsenic remained on apple foliage from sprays containing ferric oxide than from sprays containing hydrated lime as a corrective. The sulphur is much more readily washed off by rainfall from sprayed apple leaves than is the lead arsenate. Ferric oxide alone, when sprayed in concentrations of 4 lb. to 50 U.S. gals. tap water, did not cause any injury to peach or apple foliage.

GINSBURG (J. M.). **Emulsifying Properties of different Gums.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, p. 157. New Brunswick, N.J., 1929.

Various organic colloids, such as starch, dextrin, casein and skimmed milk, are efficient emulsifiers for summer oil sprays, but they are subject to bacterial decomposition, and, unless a preservative is added, the stock emulsion usually deteriorates in a few days. Tests were therefore made of 20 different gums with oils of varying viscosities in order to find an emulsifier that would not be readily attacked by bacterial action and would keep a stock emulsion stable for a considerable time. Only four gums proved efficient, namely, arabic, kino, ammoniac gamboge and galbanum Indian gum, the last named being superior to any of the others. The use of 0·5 per cent. of Indian gum was found sufficient to produce a solid emulsion, which remains stable for several weeks without the addition of a preservative.

GINSBURG (J. M.). **Oil Sprays and Emulsifiers.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 157–158. New Brunswick, N.J., 1929.

Studies of the effects of different oils on foliage were continued with the purpose of finding an oil possessing high adhesive qualities while being innocuous to plant tissue. The oils were emulsified with powdered skim milk or gums and sprayed on young peach and apple trees. The results, which are shown in a table, confirm the results of the previous year [*R.A.E.*, A, xvi, 559] in that a proprietary white oil of high viscosity is not injurious to peach or apple foliage. Of the vegetable oils tested, peanut and maize oil were the least injurious, and mustard and linseed oil the most. Peanut oil caused no injury to apple leaves and only very slight injury to peach leaves. China wood and linseed oils exhibited greater adhesion to foliage than any of the other oils tested.

GINSBURG (J. M.). **Insecticide Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 158–163. New Brunswick, N.J., 1929.

Although considerable investigations have been made in the hope of finding an internal insecticide that will not lower the market value of fruit, none has as yet been discovered that is comparable in toxicity with lead arsenate. The experiments here described were made with several groups of chemicals, tested on bees. The bees were fed on honey warmed to a flowing consistency and mixed with an equal volume of a solution or suspension of the chemical at the desired concentration. Most of the chemicals were emulsified with powdered skim milk or used in suspension; a few were dissolved in ethyl alcohol, but none of the final solutions contained more than 1 per cent. of alcohol. The chemicals consisted of plant alkaloids and other plant poisons used either in pure form or combined with other radicals, benzene derivatives and miscellaneous compounds. The results are shown in tables. An alcoholic extract of the flowers of pyrethrum (*Chrysanthemum cinerariaefolium*) and 3 : 5-dinitro-cresol were nearest in toxicity to arsenic trioxide (AS_2O_3). Dinitro-cresol is, however, also highly toxic to mammals and proved very injurious to peach foliage.

BECKWITH (C. S.) & FUDGE (B. R.). **Cranberry and Blueberry Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 164–172. New Brunswick, N.J., 1929.

The cranberry fireworm [*Rhopobota naevana*, Hb.] was so rigorously combated on the cranberry bogs of New Jersey several years ago that it was practically eliminated. Of recent years, however, it has been gradually increasing, until now it has again become one of the most injurious pests in the State. Leafhoppers, which directly damage the leaves and twigs by sucking the sap, have become much more important since they are suspected of transmitting false blossom disease. The three principal species, in the order of their abundance, are *Euscelis striatulus*, Fall. (blunt-nosed leafhopper) *Platymetopius frontalis*, Van Duzee (sharp-nosed leafhopper) and *Thamnotettix smithi*, Van Duzee (yellow leafhopper) [*R.A.E.*, A, xvii, 30].

E. striatulus winters in the egg stage. Immature stages are found in late May and throughout June, and adults appear in late June and throughout July; a few are found as late as October, but there is probably only one generation in a year. *P. frontalis* also winters in the egg stage, larvae appearing about the end of May and adults at the end of June. Eggs laid by this generation give rise to adults that are present throughout October. *T. smithi* appears in early spring in the adult stage and may possibly have spent the winter in that stage, hiding in the vegetation about the bog. Eggs are laid early, the first generation maturing during June and appearing in maximum numbers early in July. Another generation develops early in September and is on the bogs in late October. Thus all three species are in an immature stage early in June. Reflooding for one day between 5th and 10th June would undoubtedly destroy large numbers of them. A 40 per cent. nicotine solution, 1 : 50, applied about 15th June, would kill all leafhoppers with which the spray actually came into contact. Under ordinary conditions, 50 per cent. were found to be killed by this means; more thorough spraying killed 85 to 90 per cent. and spraying from both sides killed 95 per cent.

A study of the cumulative effect of acid lead arsenate on cranberry vines [xvi, 560] indicates that though regular sprayings over a period of years are harmful to the crop, occasional spraying as an emergency treatment may be resorted to with advantage.

HUTSON (R.). **Bee Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 173–177. New Brunswick, N.J., 1929.

Among the investigations relating to bees have been a study of the relation of the honey-bee to fruit production, and the breeding of strains resistant to European foulbrood. For the past two years these strains have shown considerable promise, and it is now proposed to test them over a wider range.

GAUTIER (Cl.), BONNAMOUR (S.) & GAUMONT (L.). **Sur un** *Ephedrus* **(Hym. Braconidae) parasite de** *Macrosiphoniella sanborni* **Gillette (Hem. Aphididae).**—*Bull. Soc. ent. Fr.*, 1929, no. 12, pp. 200–201. Paris, 1929.

Ephedrus plagiator var. *nigra*, n., was found in Loiret as an occasional parasite of *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., an American Aphid apparently of recent introduction into Europe, which was reproducing parthenogenetically in winter on *Chrysanthemum* grown in a sheltered position out-of-doors. The characters distinguishing this variety from the typical *E. plagiator*, Nees, are given.

DONISTHORPE (H.). *Histeromerus mystacinus*, **Wesmael; a Coleopterous Parasite.**—*Ent. Rec.*, xli, no. 9, p. 125. London, September 1929.

The Braconid, *Histeromerus mystacinus*, Wesm., is recorded as a parasite of *Leptura scutellata*, F., and *L.* (*Strangalia*) *aurulenta*, F., in England.

STANILAND (L. N.) & WALTON (C. L.). **The Long Ashton Tar-Distillate Wash: Field Experiments, 1929.**—*J. Minist. Agric.*, xxxvi, no. 6, pp. 517–523, 2 pls. London, September 1929.

A preliminary account is given of further experiments carried out during the winter of 1928–29 with the Long Ashton tar-distillate wash [*R.A.E.*, A, xvii, 120] to ascertain whether equally satisfactory results could be obtained under widely varied conditions, trials being made throughout the principal fruit-growing areas of England. The amount of emulsifier (Agral WB) used was double that originally suggested [xvi, 584], in order to make the wash more suitable for use with a wide range of waters. This form of the spray is a two-solution wash, the addition of a solution of caustic soda being necessary to effect complete emulsification. Owing to local peculiarities in the water supply of the Wisbech area [extreme salinity and hardness], a modified form of the Long Ashton wash has been prepared in which the same tar-distillate is used, but the method of emulsification is different, a one-solution wash being the result. A well-known proprietary brand of tar-distillate was used as a "standard" as in the 1927–28 trials. The washes were applied between 17th January and 9th March 1929. The results were estimated first by eye and then by taking samples of foliage trusses and fruitlets.

In the case of *Plesiocoris rugicollis*, Fall., on apples, the Long Ashton spray at a strength of 10 per cent. gave such a consistently high degree of control that further spraying in spring against this Capsid was unnecessary. All sprays at all strengths used effected complete control of Aphids and apple sucker [*Psylla mali*, Schmidb.]. Good commercial control of caterpillars was obtained by all three sprays at 10 per cent. strength, but the Long Ashton spray gave noticeably superior results. At 6 per cent. the proprietary spray did not give commercial control, but the Long Ashton wash gave results equivalent to those obtained with the proprietary wash at 10 per cent. The modified Long Ashton wash gave results slightly inferior to those obtained with the Long Ashton spray at the same strengths. No Aphids occurred on plums, but results against caterpillars on both plums and black currants were similar to those obtained on apple. Although useful commercial control was secured against *P. rugicollis* and *Lygus pabulinus*, L., on black currants, the results were not so satisfactory as those obtained against the former on apples. Aphids were only present on black currants at one centre, and these were controlled by the modified Long Ashton spray at 3 per cent. strength. In view of these results it is recommended that tar-distillate washes based on the Long Ashton formula should be used at 10 per cent. strength if Capsids are present and at 6 per cent. if they are not.

Massee (A. M.). **Note on Plum Leaf-hoppers.**—*Ent. Mon. Mag.*, lxv, no. 784, pp. 206–207. London, September 1929.

Two leafhoppers, *Typhlocyba quercus*, F., and *Erythroneura* (*Zygina*) *coryli*, Toll., were taken on plum trees in Kent in 1928 and 1929. *E. coryli*, which is the more common species in this locality, may, in dry summers, cause considerable damage to some varieties of plums. During 1928 hatching occurred from 5th to 21st May, and oviposition in the trunks and branches of plum trees was observed from the second week in October until the end of the month. During 1929 hatching was first observed on 18th May and lasted until 5th June. The plum trees on which the main hatching took place had been sprayed with a tar-distillate at a strength of 7½ per cent. during January 1928.

Walsh (G. B.). *Phaedon tumidulus* **Germ. (Col.) as a Pest on Celery** (*Apium graveolens*).—*Ent. Mon. Mag.*, lxv, no. 784, p. 209. London, September 1929.

Phaedon tumidulus, Germ., which usually infests hogweed (*Heracleum sphondylium*), is recorded as causing extensive damage to celery (*Apium graveolens*) near Scarborough. The beetles occurred in enormous numbers, more than 128 being found on one small plant. The outer leaves were first attacked, then the heart and lastly the stalks, and the destruction was so complete that the whole row had to be replanted. In a footnote J. J. Walker states that at Oxford *P. tumidulus* exhibits a decided preference for cow parsley (*Anthriscus sylvestris*), though it also occurs on *Heracleum* and other common umbelliferous plants.

Roebuck (A.). **Studies in the Genus** *Phaedon*.—*Lincs. Nat. Union Trans.*, 1927, pp. 35–42, 3 figs. Lincoln, 1928.

Phaedon tumidulus, Germ., is sometimes a pest of celery [see preceding paper]. In experiments the turgid leaves of a healthy plant were not

attacked until the beetles were short of food, the almost flaccid leaves of a crop suffering from lack of moisture being preferred. One beetle ate an average of 4·8 sq. mm. of a leaf a day, and the effect of one or two beetles is more than counterbalanced by the daily growth of the plant, but the species is gregarious and concentrates in such numbers that it destroys the plants or seriously impedes their growth. *P. armoraciae*, L., has been taken on mustard and watercress. The larvae and adults of *P. cochleariae*, F. (mustard beetle) frequently occur on cruciferous crops [*R.A.E.*, A, xii, 282], congregating in large numbers on each plant and only migrating to the next when the foliage has been entirely consumed. Although the beetles have well-developed wings, they rarely fly, but sometimes crawl long distances from their hibernating quarters to the crops on which they lay their eggs in May and June. The beetles that mature on their food-plants in summer may have some weeks to feed after harvest, so that they are forced to migrate to later crops. When cold weather begins, they crawl to their hibernating quarters. The egg, larva and pupa and the method of oviposition are briefly described. There are two overlapping generations a year; typical seasonal histories for early and late individuals of each are given; in the first generation, adults resulting from eggs laid between 15th May and 26th June emerge between 15th June and 30th July, and adults of the second generation from eggs laid between 23rd June and 10th August emerge between 27th July and 10th September. The habits of *P. cochleariae* when feeding in watercress beds are described [*cf. R.A.E.*, A, iv, 356]. It was found that the hairs, bristles and tubercles on the body of the larva prevent it from being wetted, and when it reaches the water, it progresses along the surface with an eel-like motion. To control the pest, the plants should be held down with planks and wire netting, so that the beetles float off and drift to the outlet, where they can be scooped out in buckets. Stray individuals passing over the banks may be caught on tarred boards.

THEOBALD (F. V.). **Some Notes on injurious Insects and other Animals in 1928.**—*J. S.-E. Agric. Coll.*, no. 26, pp. 104–116, 5 figs. Wye, Kent, 1929.

Pests of hops included *Agrotis* (*Tryphaena*) *pronuba*, L., and *Lygus spinolae*, Mey., both recorded on them for the first time, and *Aphis rumicis*, L., which attacked the leaves in July, the Aphids becoming winged in August and migrating. The eggs of *A. pronuba* were discovered on the leaves in August; soon after hatching in September the larvae go into hibernation.

Apples not sprayed with tar distillates were unusually severely infested by *Rhopalosiphum prunifoliae*, Fitch, followed by *Anuraphis roseus*, Bak. Dusting loganberries with 2 per cent. nicotine gave good results against *Macrosiphum rubiellum*, Theo. Blackberries and in one case raspberries were also severely attacked. *Myzus cerasi*, F., on cherries was successfully controlled by tar distillates. Damage up to 70 per cent. to apple blossoms was caused by *Anthonomus pomorum*, L.; good results in controlling it were obtained by banding and by letting ducks feed in the orchard. Where banding was impracticable on bush trees, bunches of sacking hung in the branches were found to attract the weevils in large numbers. *Cydia* (*Opadia*) *funebrana*, Tr., was very prevalent, particularly on victoria plum. Trap bands are recommended against it. Severe infestations of *Tipula oleracea*, L. (leather jackets)

on strawberries were successfully controlled by the use of Paris green and bran bait. *Cladius pectinicornis*, Fourcr. (strawberry sawfly) attacked strawberries in two localities. The larvae, cocoons and adults are described. The eggs are deposited under the leaves and hatch in a few days in the summer. The larval stage lasts 4 or 5 weeks and the pupal stage 17–22 days. Two generations occur ; the first appears in June and the second in late August and September. The larvae of the second generation hibernate in the soil and among the lower leaves. Spraying with strong lead arsenate against the larvae of the second generation and subsequent burning of leaves is recommended.

Other fruit pests included *Eucosma* (*Aspis*) *uddmanniana*, L., on loganberries, *Barypithes* (*Exomias*) *araneiformis*, Schr., on strawberries, *Tacniocampa pulverulenta*, Esp., and *Arctornis* (*Leucoma*) *chrysorrhoea*, L., on apples, *Caliroa* (*Eriocampoides*) *limacina*, Retz., on pear, cherry and apple, and *Lepidosaphes ulmi*, L., on pear. Numerous larvae of *Ametastegia* (*Taxonus*) *glabrata*, Fall. (dock sawfly) were found hibernating under bands of sacking on apple trees. As regards *Eriosoma lanigerum*, Hausm. (woolly apple aphis), it was found that in spraying with tar distillates good control of the subterranean form will also be obtained, if the ground beneath the trees is well soaked with the spray.

Sciara annulata, Mg., was found damaging mushroom spawn in the soil. The pupal stage of this fly, which is passed near the surface, lasts 5–9 days. Mating takes place a few days after emergence ; the eggs are laid just under the surface of the soil and hatch in 3–5 days. Serious damage to asparagus was caused by *Crioceris asparagi*, L. The eggs are laid on the heads and later on the leafy shoots. If some of the earlier shoots are left to grow and come into leaf, they serve as traps, being preferred by the beetles for oviposition. After the crop has been cut, the maturing shoots can be sprayed with strong nicotine and soap or with lead arsenate. All hedgerow seedlings should be destroyed, as they form a source of fresh infestation.

A severe outbreak of *Plutella maculipennis*, Curt., occurred in 1928 over a considerable area, wallflowers and stocks and other cruciferous crops being attacked. The best spray used against it consisted of 4 oz. nicotine and 2 lb. lead arsenate to 80 gals. water, but nicotine dust was still more effective. Other vegetable pests included *Trifidaphis phaseoli*, Pass., on the roots of beans, and *Achorutes armatus*, Nic., on seedlings of crucifers and lettuce and in some places on mushrooms.

THEOBALD (F. V.). **A simple Diagnosis of the Plant Lice of *Ribes* and Apple.**—*J. S.-E. Agric. Coll.*, no. 26, pp. 117–123, 1 pl. Wye, Kent, 1929.

Keys are given to the apterous and alate viviparous females of the Aphids that occur on currants and gooseberries and on apple in Britain, with a brief description of each species and notes on its biology. Species attacking both currants and gooseberries are *Amphorophora cosmopolitana*, Mason, *A. britteni*, Theo., *Myzus lactucae*, Schr., *Capitophorus* (*Myzus*) *ribis*, L., *Aphis grossulariae*, Kalt., and *Eriosoma ulmi*, L., which occurs on the underground parts of the plants. *Rhopalosiphoninus ribesina*, v. d. G., on red currants, has only been once recorded in Britain. *Periphyllus testudinatus*, Thornton, which is common on *Acer*, has been found on three occasions on currants. The species attacking apple are *Aphis pomi*, DeG., *A. rumicis*, L., *Anuraphis roseus*, Bak., *A. crataegi*,

Kalt., *A. petherbridgei*, Theo., *Rhopalosiphum prunifoliae*, Fitch, *Cinara* (*Pterochlorus*) *saligna*, Gmel., and *Eriosoma lanigerum*, Hausm.

Austin (M. D.). **Pyrethrum Experiments, 1928.**—*J. S.-E. Agric. Coll.*, no. 26, pp. 124–135. Wye, Kent, 1929.

This is an account of further experiments with pyrethrum sprays to compare the efficiency of the alcoholic and aqueous extracts [*R.A.E.*, A, xvi, 618]. The heads, flowers, and the whole of the stalks of *Chrysanthemum cinerariaefolium* were used in preparing the alcoholic extract. The French method of preparation is to soak 50 gms. of dried flowers (whole) in 100 c.c. alcohol (80 per cent.). This mixture is left for eight days and then filtered. When required for use, 60 gms. white soap and 200 cc. water are added and the mixture is then diluted to the strength required; 1 part in 9 parts water, termed single strength, was used unless otherwise stated. During these tests it was found necessary to add some of the water before filtration. The method of preparing the aqueous extract was the same as that employed previously [*loc. cit.*]. French pyrethrum was used in the tests described, no appreciable difference in results having been obtained with Japanese material.

Alcoholic sprays were tested in the field, laboratory experiments in many cases giving similar results, against a number of Aphids, and the following percentages of mortality were obtained: *Eriosoma lanigerum*, Hausm. (woolly aphis), 45; *Aphis rumicis*, L. (bean aphis), 70; *Macrosiphum rosae*, L. (rose aphis), 62–94 (61–80 with aqueous extract); *Myzus cerasi*, F. (cherry aphis), 78 (72 with aqueous extract); *Capitophorus ribis*, L., and *Myzus lacticae*, Schr. (red currant Aphids), 95 (88 with aqueous extract); *Myzocallis coryli*, Goeze (nut aphis), 95 (98 with nicotine and soft soap); *Anuraphis roseus*, Bak. (apple aphis), 80–85; *Brevicoryne brassicae*, L. (mealy cabbage aphis), 50 (30–35 with aqueous extract); *Hyalopterus arundinis*, F. (mealy plum aphis), 80 (76 with aqueous extract, and 85 with nicotine and soft soap); *Phorodon humuli*, Schr. (hop aphis), 78 96 (63–86 with aqueous extract, and 95 with nicotine and soft soap); *Myzus persicae*, Sulz. (turnip aphis), 50 (25 with aqueous extract).

Although aqueous as well as alcoholic extracts of single, double and, in one instance, treble strengths were used, no appreciable results were obtained with *Pteronus* (*Nematus*) *pini*, L. (pine sawfly), *Hemerophila pariana*, Cl. (apple leaf skeletoniser), Capsids on potatoes, flea-beetles [*Phyllotreta*] and larvae of *Abraxas grossulariata*, L. Though only the smaller larvae of *Barathra* (*Mamestra*) *brassicae*, L., were affected, the percentages of these killed were 22–56 with alcoholic and 10 with aqueous extract. Even at treble strength the alcoholic extract killed only 5 per cent. of the larvae of *Pieris* (*Pontia*) *brassicae*, L. Thirty per cent. of the larvae of *Plutella maculipennis*, Curt., were killed with alcoholic extract, but only 10 per cent. with aqueous extract, even at treble strength.

Tests with alcoholic and aqueous sprays at various strengths were carried out against *Coccus* (*Lecanium*) *hesperidum*, L., on ferns. Two applications of the alcoholic extract at double strength at an interval of a few days gave almost complete control. Results with Volck (2 per cent.) were not so good, and the spray tended to make the leaves transparent.

Alcoholic extract in most cases gave almost complete control of red spiders [*Paratetranychus pilosus*, C. & F., and *Tetranychus telarius*, L.], but the results with aqueous extract were poor.

AUSTIN (M. D.). **Observations on the Eggs of the Apple Capsid (*Plesiocoris rugicollis* Fall.) and the Common Green Capsid (*Lygus pabulinus* L.).**—*J. S.-E. Agric. Coll.*, no. 26, pp. 136–144, 4 figs., 2 refs. Wye, Kent, 1929.

These observations on the eggs of *Plesiocoris rugicollis*, Fall. (apple Capsid) and *Lygus pabulinus*, L. (common green Capsid), descriptions of which are given, were made in order to determine the reason for the variation in results obtained when tar distillate sprays were used against the former.

The eggs of *P. rugicollis* are laid on apple from the end of June to the middle of July, usually singly, in lenticels or wounds in the bark, or sometimes in slits made for the purpose by the female. Several eggs may be laid together, but each is in a separate cavity. The younger wood is normally chosen, but oviposition may also take place in older branches and main stems. Most of the eggs hatch about April, the remainder hatching over an extended period. They are usually completely inserted into the tissues, their caps being flush with the bark.

Several varieties of infested trees were inspected. In one variety only, the eggs were crushed, in some instances, by the plant tissues and killed. It is concluded that the hardness of the wood apparently has little if any effect on the results obtained with tar distillates, since the angle and depth of insertion of the egg are not constant for any particular variety of apple.

The winter eggs of *L. pabulinus*, which hatch about April, are laid during September and early October, usually in the young wood of currants, gooseberries, etc., and occasionally in the main stems of the bushes. Their position in the wood is similar to that of the eggs of *P. rugicollis*, but frequently they lie in the bark parallel to the long axis of the twig. Although the cap of the egg is usually flush with the bark, it becomes more exposed by the natural peeling of the bark in the autumn. Frequently the tissues surrounding the egg may become hardened. The eggs of the spring generation are laid in herbaceous plants in June and July and hatch about 3 weeks later.

NEWTON (H. C. F.). **Observations on the Biology of some Flea-beetles of economic Importance.**—*J. S.-E. Agric. Coll.*, no. 26, pp. 145–164, 27 figs., 33 refs. Wye, Kent, 1929.

Serious injury to belladonna (*Atropa belladonna*) by *Epitrix atropae*, Foudr. (belladonna flea-beetle), all stages of which are described, was recorded in England in 1908–10, and a further outbreak occurred from 1921 to 1926. Two crops are harvested during the year, in June and August, and the bulk of the damage is done to the second. The plants are left in the ground for 3-year periods, and this enables the beetles to increase rapidly. The adults hibernate in grass or other shelter near infested fields, and they appear on the young plants at the end of April or early in May, when mating takes place. Oviposition begins immediately and continues until June or early July. In the field the overwintering beetles had disappeared by 7th July. The eggs are laid singly or in groups of 6 or 7 at a depth of 1–3 cm. in the soil and hatch in 15–28 days. Under laboratory conditions at 60° F. they hatched in 11–13 days. The larval stage lasts about 21 days and the pupal 15–17. The nature of the damage to the leaves by the adults, the new generation of which is particularly injurious in August, is described. Attacks by the larvae on the roots considerably affect the yield of the second crop.

The beetles can be controlled by disturbing and catching them in nets or on sticky shields during August or after harvest, when by leaving a small area of the second crop standing, they are further concentrated. Various sprays were used with little success. It was found that *E. atropae* fed readily on *Hyocyamus niger*, and a few individuals were found on thorn apple (*Datura*). A brief review is given of the economic importance of the species of the genus *Epitrix* in various parts of the world.

The literature on *Chaetocnema* (*Plectroscelis*) *concinna*, Mshm. (brassy tooth-legged flea-beetle) is briefly reviewed, and it is concluded that although it has been recorded as a pest of hops its occurrence on this plant and on crucifers is purely accidental. It has recently caused considerable injury to mangel seedlings, but in these observations both adults and larvae were only observed on Polygonaceae. Even when the beetles were numerous on rhubarb adjacent to hops, the latter were not attacked. At Wye the larvae were found feeding on the roots of rhubarb, buckwheat (*Fagopyrum*) and *Rumex* spp. and the adults on the leaves of these and other polygonaceous plants. The beetles hibernate in tufts of grass, etc., and appear and pair at the end of April. The eggs are deposited in the soil around the food-plant, the incubation period lasting 15–28 days or even longer. The immature stages are described.

In July 1926, larvae of *Chaetocnema hortensis*, Geoff. (*aridella*, Payk.) were found mining in the stems of barley. In the laboratory the prepupal stage lasted 6–8 days and the pupal 18–21. In the field the mature larvae bored their way out of the stem near the ground level and pupated in the soil. Descriptions of the larvae and pupae are given.

Psylliodes attennuata, Koch, the only flea-beetle known to attack hops in England, has often been mistaken for *C. concinna*. There is only one generation a year. The adults hibernate in tufts of grass and rough undergrowth. The beetles emerge and mate at the end of April and attack the young shoots in May. The first eggs were found on 3rd May and oviposition continued until the end of June. The overwintering adults disappear in July. The eggs are laid in the soil, where the larvae feed on the roots and pupate. In pots in the open the eggs hatched in 33–35 days, the larvae fed for about a month, and the the first adult appeared 84 days after the eggs were laid. The newly emerged beetles feed on the leaves and the cones, and injury to the latter appears to be the most serious aspect of an infestation. They also occur on *Urtica dioica*. Spraying with nicotine for Aphids killed a number of the beetles on the plants. The immature stages are described.

The adults of *Psylliodes affinis*, Payk., which is often a pest of potato, were observed on *Solanum dulcamara* in June 1926, when oviposition occurred in the soil. By July the overwintering beetles had disappeared, and shortly afterwards fully grown larvae and early prepupae were found around the roots. One generation occurs during the year. Records of the food-plants and economic importance of this beetle are briefly reviewed, and the immature stages are described.

Adults of *Psylliodes chrysocephala*, L. (cabbage stem flea-beetle) were noticed on winter kale in November and January, and mating was observed in the latter month. Oviposition occurred between the end of January and the beginning of May, but probably began the previous autumn. The winter is passed in the adult, egg and larval stages ;

it is probable that eggs laid from December onwards do not hatch until May. Pupae were found in the soil in early August, and a few adults were observed in field cages later in the month. Newly hatched larvae placed in a pot containing crucifer seedlings bored into the stems at ground level and soon killed the plants. Larvae placed on older plants failed to penetrate the stems and burrowed into the ground. The literature indicates that *P. chrysocephala* will attack almost any cultivated crucifers.

SACHTLEBEN (H.). **Die Forleule** *Panolis flammea* **Schiff.** [The Pine Moth, *P. flammea.*]—*Monogr. Pflanzenschutz*, no. 3, iv + 160 pp., 1 pl., 35 figs., 10 pp. refs. Berlin, Julius Springer, 1929. Price, paper, *M.* 15.80.

In this monograph on *Panolis flammea*, Schiff., the author draws largely on his own previous work and collates his results with those of other investigators. Much of the information given concerning the life-history and control of the pine-moth has already been noticed from an earlier paper [*R.A.E.*, A, xvi, 178]. A historical review is given of outbreaks of *P. flammea* in Germany and in other countries during the past 200 years, the synonymy and distribution of the moth are discussed, and all its stages are described It is concluded from the evidence collected that in addition to *Pinus silvestris*, the preferred food-plant, and *P. strobus*, the larvae occasionally feed on other species of pine [*loc. cit.*], and also on *Picea excelsa, Pseudotsuga taxifolia* (*douglasi*), *Abies pectinata, Juniperus communis, Quercus, Betula, Salix, Pteris aquilina* and *Larix europaea.*

In addition to parasites and hyperparasites [*loc. cit.*], the natural enemies dealt with include mammals, birds and various Arthropods, as well as fungous diseases and polyhedral disease. The conditions that bring about, maintain and terminate an infestation are discussed in detail, and a chapter is devoted to the recovery of pine trees after attack.

MERKEL (L.). **Beiträge zur Kenntnis der Mosaikkrankheit der Familie der Papilionaceen.** [Contributions to the Knowledge of Mosaic in Papilionaceae.]—*Z. PflKrankh.*, xxxix, no 8–9, pp. 289–347, 12 figs., 35 refs. Stuttgart, 1929.

An account is given of investigations conducted in Germany on mosaic disease of beans, peas, clover, lucerne, lupins and other leguminous plants. The symptoms of the disease are fully described in the case of each plant. Though there is no sharp differentiation, each plant has a typical form, and in some cases two forms occur in the same species of plant. Attempts to transmit the disease by inoculation were unsuccessful, but in almost all experiments it was transmitted by *Aphis fabae*, Scop., and *Macrosiphum pisi*, Kalt., between plants of the same or different species. The transmission experiments of Doolittle & Jones [*R.A.E.*, A, xiv, 164] are compared, and it is concluded that the mosaics of the various species of Papilionaceae are caused by one and the same virus. Further studies showed that the virus passes the winter either in the plant itself, as in the case of clover, or in the seed, as in the case of annuals, but not in the winter eggs of the Aphids. The virulence of the disease decreases with the continued absence of the Aphid from infected plants.

Reckenthäler (P.). *Agrotis segetum*, **ein Massenschädling in Rebschulen.** [*A. segetum*, a Pest in Vine Nurseries.]—*Int. ent. Z.*, xxiii, no. 19, pp. 225–226. Guben, 15th August 1929.

Euxoa (*Agrotis*) *segetum*, Schiff., is recorded from Prussia as occurring in large numbers on vines in nurseries, where it kills thousands of plants by feeding on the young shoots.

Thomsen (M.). **Zur Biologie der** *Hoplocampa testudinea* **Kl. (Vorläufige Mitteilung).**—*Anz. Schädlingsk.*, v, no. 7, pp. 80–84, 7 figs., 8 refs. Berlin, 1929.

The main area of distribution of *Hoplocampa testudinea*, Klug (apple sawfly), the most serious pest of apple in many parts of Denmark, is in western Europe. It is abundant in Holland, Germany and England and has been recorded from western France and from Florence, though it is rare in southern Europe. A record of *H. testudinea* from northern Russia on *Sorbus aucuparia* as well as on apple is probably due to confusion with another species, *H. alpina*, Zett., which occurs in Finland on the former plant. A preliminary account is given of life-history studies begun in 1927. The eggs are deposited at the base of the calyx-lobes of apple as soon as the petals open and hatch in 6–8 days. The larva generally makes its exit through the wall of the fruit, piercing it afresh to begin boring; it is rare to find more than one in a single fruit. A narrow tunnel is first made immediately beneath the skin and visible through it, the apple becoming deformed even if the larva then leaves it. Usually, however, it bores into the fruit and devours the seed. As many as four apples may be attacked by one larva. The mature larvae leave the fruit during July and drop to the ground, where at no great depth they spin cocoons in which they hibernate, pupating in the following spring. Infested apples drop during the summer or sometimes wither on the tree; only those with slight superficial borings develop.

Zolk (K.). **Der Meerrettichblattkäfer** (*Phaedon cochleariae* **Fbr.).** [The Mustard Leaf Beetle, *P. cochleariae*, F.]—*Tartu Ulikooli Entomoloogia-Katsejaama Teadaamed*, no. 7, Agronomia 1928. [Dorpat, 1928.] (Abstract in *Anz. Schädlingsk.*, v, no. 7, pp. 84–85. Berlin, 1929.)

Life-history studies of *Phaedon cochleariae*, F., on mustard in Estonia show that the adults emerge from hibernation in May but may again become inactive if the temperature falls below 9° C. [48·2° F.], and mating, which, together with oviposition, is described, does not take place until the average temperature reaches 14° C. [57·2° F.]. Many adults emerging in August mated the same autumn. Oviposition begins 4–16 days after mating, and as many as 650 eggs may be laid in batches by one female. Although a second generation may be produced under exceptionally favourable circumstances, the number of individuals in proportion to the eggs is so small that the annual total is very little increased. A development curve, constructed according to Blunck's formula [*R.A.E.*, A, xiii, 389] from data arrived at from a comparison of the relative development periods and average temperatures of the years 1927 and 1928 (26 days at 22·2° C. [72° F.] and 39 days at 17·4° C. [63·3° F.]), showed that the period of development lasts 170 days at

10° C. [50° F.], 117 days at 11° C. [51·8° F.], 60 days at 14° C. [57·2° F.], etc., though it was not possible to establish experimentally the optimum conditions.

Climatic conditions in June, July and August are decisive factors in the development of this Chrysomelid. The average outdoor temperature in Estonia for these months over a period of 50 years is 15·7° C. [60·3° F.], according to which the period required for development is 47·4 days. With the addition of 19·5 days for the pre-oviposition period of the young beetles, the total period is increased to 66·9 days and terminates in the first half of August. As the average temperature for September is 10·57° C. [51° F.], at which 135 days are required for development, it is clear that there cannot normally be more than one generation in Estonia. Embryonic development lasts 7–9 days at a temperature of 23° C. [73·4° F.]. The various larval instars are described, and the times occupied by each at different temperatures are given. Pupation takes place in the ground, just below the surface. The pupal stage lasts 9 days at a temperature of 20·2° C. [68·4° F.].

FRIEDRICHS (K.). **Fortschritt in der Bekämpfung von Rapsschädlingen.** [Progress in the Control of Rape Pests.]—*Anz. Schädlingsk.*, v, no. 8, pp. 88–90, 2 refs. Berlin, 1929.

Various types of apparatus for catching beetles that attack rape are reviewed [*R.A.E.*, A, xii, 292; xiii, 437]. The author suggests that the improved horse-drawn machine [xvii, 484], which he considers the best, could be rendered more efficient by covering the backboard of the tray with fabric soaked in paraffin and water to prevent the escape of any beetles that might crawl up it, and by dividing the tray into several compartments to minimise spilling when the apparatus is used on uneven ground.

BAKO (G.). **Die Traubenwicklerfrage in Ungarn.** [The Vine Moth Problem in Hungary.]—*Anz. Schädlingsk.*, v, no. 8, pp. 90–93, 2 refs. Berlin, 1929.

Control measures employed against *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., in Hungary during the past thirty years are briefly reviewed. It is concluded that the vine moths can be effectively controlled only in the spring generation, and that contact poisons alone are inadequate, as they fail to prevent the injury caused by the young larvae in the blossom buds. The various means of determining the date at which to apply treatment are discussed, and the author considers that the stage of development of the vine gives more certain indication than observations of the flight or oviposition of the moths. The first application of Bordeaux mixture and an arsenical (Paris green, etc.), directed against both *Peronospora* and the vine moths, should be made when the clusters first appear in the earliest varieties and repeated twice at intervals of 7–8 days. When the clusters have become covered with foliage, between 20th and 25th May, this combined treatment is no longer satisfactory, and a spray of an arsenical alone, using revolving nozzles to reach the hidden clusters, should be applied twice at an interval of 7–8 days. If necessary, a further spray of either kind may be applied.

After the application of these measures in 1927 in a vineyard where infestation amounted to 10 eggs to every cluster on 18th May, no

flight of moths was observed at the time of the second generation, nor was it possible to find eggs on the grapes on 28th July. Further examination on 1st September failed to reveal any infested grapes. A neighbouring untreated vineyard showed evidence of severe infestation by both generations. It is estimated that the cost of six applications was only one-tenth of the value of the additional crop secured. An arsenic content of 0·85 per mille in the combined spray and 1·13 per mille in the other one proved sufficient to secure control without scorching the foliage when the sprays were applied in cool, damp weather.

Leitsätze für die Rebschädlingsbekämpfung. [Rules for the Control of Vine Pests.]—*Anz. Schädlingsk.*, v, no. 8, pp. 94–95. Berlin, 1929.

Particulars are given of a series of recommendations laid down by the Pest Control Committee of the German Vinegrowers' Association for combating insect pests and diseases of the vine, including instructions for the preparation of various insecticides.

Cords-Parchim (–). **Vom Holzbock und seiner Bekämpfung.** [The Control of *H. bajulus*, L.]—*Baumwelt*, xx, no. 20, p. 456, 1929. (Abstract in *Anz. Schädlingsk.*, v, no. 8, p. 95. Berlin, 1929.)

The distribution of *Hylotrupes bajulus*, L., in north-western Germany and Denmark is discussed. Hydrocyanic acid gas is effective for destroying the larvae, particularly in summer when they are most active, but it is not always possible to apply it. Exposed timber in mills that had been fumigated for a considerable time with HCN against *Ephestia kühniella*, Zell., was free from this beetle, whereas timber walled-up in other parts of the room was heavily infested.

Biro (B.). **Die Mischung des zur Insektenvertilgung verwendeten Cyanwasserstoffs mit Warnungstoffen.** [The Addition of Irritants to Hydrocyanic Acid when used for the Destruction of Insects.] [In Magyar.]—*Népegészségügy*, 1929. (Abstract in *Anz. Schädlingsk.*, v, no. 8, p. 95. Berlin, 1929.)

An account is given of the extent to which hydrocyanic acid is used in different countries, and the advantages of this fumigant over sulphur dioxide and carbon bisulphide are discussed. As several accidents have occurred in Hungary during the fumigation of houses, the author is of the opinion that the use of HCN should not be permitted without the addition of an irritant (warning) gas. Zyklon is considered to fulfil all requirements.

Hock (R.). **Beitrag zur Kenntnis von der Vernichtung von Schädlingen in Aufbewahrungsstätten von Lebensmitteln.** [Contribution to the Knowledge of the Destruction of Pests in Food Storage Warehouses.]—*Z. Fleisch- u. Milchhyg.*, xxxix, no. 8, pp. 140–143, 1929. (Abstract in *Anz. Schädlingsk.*, v, no. 8, p. 96. Berlin, 1929.)

Experiments in fumigating refrigerated meat showed that hydrocyanic acid gas is only retained in small quantities, and that even when the meat is eaten raw there is no danger to health. Fresh veal retains the smell

of the gas longest. Minced meat should be kept several days in the fresh air after fumigation. It is recommended that fresh veal and salted meat should be removed from cold-storage houses before fumigation. Zyklon B is considered the best fumigant for the purpose.

MAAS (I.). **Cyanogas Schäden bei Cinerarien.** [Cyanogas Injury to *Cineraria*.]—*Gärtenwelt*, xxxiii, no. 16, p. 217, 1929. (Abstract in *Anz. Schädlingsk.*, v, no. 8, p. 95. Berlin, 1929.)

Fumigation with 30 gm. calcium cyanide to 100 cu. m. was observed to cause injury to blossoms and buds of *Cineraria*. It is therefore suggested that large woody plants of this nature should be treated before the buds open. According to an editorial note, *Cineraria* can support a dosage of 45 gm. to 100 cu. m., provided that the plants are absolutely dry.

HAHMANN (C.). **Schädigung an Cinerarien durch Begasung mit Cyanogas.** [Injury to *Cineraria* from Fumigation with Cyanogas.] —*Blumen- und Pflanzenbau*, xliv, no. 6, pp. 108–110, 1929. (Abstract in *Anz. Schädlingsk.*, v, no. 8, p. 97. Berlin, 1929.)

Studies of the damage caused to *Cineraria* by fumigation with calcium cyanide gas have shown that in every case injury was due, not to the extreme sensitiveness of the plants, but to the excessively humid conditions in which they were maintained.

EXT (—). **Die Rübenblattwanze im Anhaltischen Befallgebiet (Eine Richtigstellung).** [The Beet Leaf Bug in the attacked Region in Anhalt. (A Correction.)]—*Anz. Schädlingsk.*, v, no. 8, p. 97. Berlin, 1929.

The author discusses some statements attributed to him by Schubert in a paper already noticed [*R.A.E.*, A, xvi, 1] and considers that Schubert's assertion that heavy soil favours infestation by *Piesma quadrata*, Fieb., requires confirmation.

GÖTZE (G.). **Die kleine Wachsmotte** (*Achroia grisella* **F.**) **als Samenfresser.** [The small Wax Moth, *A. grisella*, F., as a Pest of Seeds.] —*Anz. Schädlingsk.*, v, no. 8, pp. 97–98. Berlin, 1929.

Larvae of *Achroia grisella*, F., found infesting seeds of *Polygonatum officinale* and kept in a corked glass tube devoured all the seeds, and after tunnelling through the cork, pupated and produced adults. In experiments, larvae fed on walnut, rape seed and pine seed produced adults, though the period of development was distinctly longer than in the case of larvae fed on wax. The fact that *A. grisella* may develop on oily seeds affords a possible explanation of the appearance of the moths in deserted hives situated at a distance of 2½ miles from occupied ones. This has hitherto been attributed to the presence of honey-bees in neighbouring trees, but it is now thought that the larvae may develop in ripe pine cones, the adults migrating to honeycombs in neighbouring deserted hives. It has not yet been ascertained whether the larvae can develop on bumble-bee wax.

Stellwaag (F.). **Giftigkeit und Giftwert der Insecticide. I. Teil : Grundsätzliche Erörterungen.** Toxicity and Toxic Value of Insecticides. Part I. Discussion of Fundamental Principles.]—*Anz. Schädlingsk.*, v, no. 9, pp. 101–107. Berlin, 1929.

This paper, which is the first of a series, discusses the methods hitherto employed to estimate and compare the values of different insecticides, particularly in respect of their toxicity, and it defines the terms to be used in this connection. The methods are classified as those designed to determine the toxic effect of a poison within a given time ; those that seek to arrive at an exact estimate of the dose taken ; and those that attempt to analyse the quantity of poison found in the body of the insect in relation to the weight of that body. A brief account is given of the application of these methods by various authors and of the results obtained, and it is pointed out that some means of rendering such results comparable is essential.

de Fremery (P.). **Koprabefall durch ein omnivores Insekt.** [Attack on Copra by an omnivorous Insect.]—*De Indische Mercuur*, lii, p. 399, 1929. (Abstract in *Tropenpflanzer*, xxxii, no. 9, p. 390. Berlin, September 1929.)

The larvae of *Silvanus surinamensis*, L., a beetle found in various products carried in the holds of ships, but believed by many authors to feed only on insects occurring in them, are recorded as feeding freely on copra, particularly if it was partly rotted by bacteria.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst.*, Beilage ii, no. 4, pp. 157–200. Berlin, 1st September 1929.

This issue includes legislation regulating the importation of raw cherries into Germany as a precaution against the introduction of *Rhagoletis cerasi*, L. (cherry fruit-fly).

Flos (—). **Was können wir gegen den Kiefernspanner tun ?** [What can we do against *Bupalus piniarius*, L. ?]—*Deuts. Forstwirt*, xi, pp. 273–277, 281–285. Berlin, 1929. (Abstract in *NachrBl. deuts. PflSchDienst*, ix, no. 9, pp. 79–80. Berlin, September 1929.)

This paper, in which the author reviews the literature and records the results of his own observations and experiments with *Bupalus piniarius*, L., in Dessau, gives a brief account of the life-history and appearance of the moth and a detailed description of the technique of making test collections. The importance of mixed plantations for bringing about or checking infestations is discussed. Various control measures are dealt with, including clearance of forest litter, the use of pigs and poultry, bird protection, and the distribution of arsenical dusts by aeroplane. When the litter collected cannot be put to any good use, it should be piled in heaps and trodden down firmly. An area in which pigs and fowls had been released in 1928 showed a reduction in the number of pupae present of about 90 per cent. Between 4th April and 4th July 100 fowls cleared about 180 acres, part of which had previously been roughly worked over by pigs. A new type of an artificial nest for the preservation of wild birds is described and compared with other types. An account is also given of a dusting campaign against *B. piniarius* by means of aeroplanes and power dusters, but this method is only recommended as a last resource.

Kaufmann (O.). **Stand der Rübenfliege im Jahre 1928.** [Status of the Beet-fly in 1928.]—*Zuckerrübenbau*, xi, p. 103, 1929. (Abstract in *Fortschr. Landw.*, iv, no. 17, p. 573. Berlin, 1st September 1929.)

The method formerly adopted for controlling the beet-fly [*Pegomyia hyoscyami*, Panz.] in Silesia by means of sodium fluoride bait-sprays has been found inadequate against the first generation. This is attributed to variations in the habits of the flies, which, although they emerge in summer in the beet-fields, where they feed and readily consume bait, come to the plants in spring from last year's fields, already fed and ready for oviposition. The bait prescribed by Schander and Götze [*R.A.E.*, A, xvii, 333] is ineffective against the first generation and is considered uncertain against the second and third. In experiments against the larvae in the leaves, none of the materials used, which included nicotine and a 6 per cent. solution of barium chloride, proved satisfactory. Examination of hibernating pupae from Silesia indicated a considerable infestation for the following year, particularly in the southern part of the Breslau district. The percentages of parasitism are given [*R.A.E.*, A, xvii, 600].

Kästner (A.). **Untersuchungen zur Lebensweise und Bekämpfung der Zwiebelfliege** (*Hylemyia antiqua* **Meigen). II. Teil. Morphologie und Biologie.** [Investigations on the Biology and Control of the Onion Fly, *H. antiqua*. Part ii. Morphology and Biology.]—*Z. Morph. Oekol. Tiere*, xv, no. 3, pp. 363–422, 28 figs., 16 refs. Berlin, 1929.

These investigations represent a further instalment [*R.A.E.*, A, xvii, 460] of a study of *Hylemyia antiqua*, Mg., in the onion district of Calbe, Saxony. In the field the adult lives for 3–4 weeks, but in captivity it may survive as long as 3 months. Three generations were observed in 1927 and 1928, the adults occurring in May–June, July–August and September–October and flying in large numbers in the morning and evening. They feed on the nectar of various flowers, in the spring chiefly on chervil, in early summer on onion and in late summer on yarrow. If the food given in captivity contained no albumen, no eggs were produced. The number of eggs per female averages 40–50 in the field; in captivity it may be as high as 80. In June the eggs are generally deposited low down on the onion plants, preferably on small ones, and on the leaves later. The larvae hatch in 3–4 days and pupate after 2–3 weeks near the surface of the soil, close to the plants. In summer the pupae develop in 2 or 3 weeks, but later on they nearly all hibernate. Natural enemies are of little importance.

Del Guercio (G.). **Il male del giallume (o dei Microbi poliedrici) negli allevamenti dei filugelli, negli insetti delle piante forestali ed agrarie e nelle zanzare della malaria.** [Grasserie (or the polyhedral Microbe Disease) in Silkworm Broods, in Insect Pests of Forests and Agriculture, and in malarial Mosquitos.]—*Redia*, xvii, pp. 1–296, 313–315, 14 figs., 13 pls., 31 pp. refs. Florence, 12th July 1929.

This treatise draws attention to the importance in the control of insect pests of diseases caused by micro-organisms. In an introductory note, the complete natural cessation of an outbreak of the larch tortrix,

Enarmonia (*Steganoptycha*) *diniana*, Gn., in North Italy in 1927, is mentioned as a recent example. It is believed that the artificial dissemination of such diseases will become an important branch of insect control. Though failure has attended attempts to use them against locusts, they have not been the subject of detailed research such as has been devoted to perfecting chemical insecticides.

The micro-organisms forming the subject of this treatise are the polyhedral, vegetable organisms that give rise to grasserie in silkworms (*Bombyx mori*, L.) and many other insects. They appear to be peculiar to insects and to resemble bacteria to some extent. For this reason they are here assembled under the general name of Entomococci. A description is given of these organisms, regarding which the most contradictory opinions have been expressed. The author refers them to the genus *Entomococcus*, which is divided into a number of subgenera according to the structure of the polyhedral bodies. There are 71 species, including, for example, *Entomococcus bombycinus* (one of 5 infecting *B. mori*) ; *E. neustriae*, infecting *Malacosoma neustria*, L. ; *E.* (*Oococcus*) *bolleanus*, infecting *Lymantria monacha*, L. ; and *E. epididiaspis*, infecting *Epidiaspis pyricola*, Del Guerc. A list is given of the species and their insect hosts, and each of these is then dealt with separately, its characters and effect on the host being discussed in more or less detail.

[Vukasović (P.) & Kostić (D.).] **Вукасовић (П.) и Костић (Д.). The Control of *Lecanium corni* on Plums.** [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda*, iv (vii), no. 1–3, pp. 10–21, 2 figs., 2 refs. Belgrade, 1929. (With a Summary in French.)

An account is given of laboratory experiments carried out in Belgrade in 1929 with various insecticides, including 5 proprietary materials, for the control of *Lecanium corni*, Bch., which is an important pest of plums in Serbia [*R.A.E.*, A, xvii, 209]. Tobacco extract (3 per cent. nicotine), 8 : 100, with 1 per cent. soap, killed 94 per cent. ; a 6 per cent. kerosene emulsion killed 98 per cent. ; and emulsions of lubricating oils proved even more effective.

[Vereshchagin (B.).] **Верещагин (Б.). On the Meadow Moth.** [*In Russian.*]—*Sel'skokhoz. Byull.*, no. 7–8, extract 2 pp. Kishinev, July–August 1929.

[Vereshchagin.] **Верещагин. On the Control of the Meadow Moth.** [*In Russian.*]—*Furnika*, no. 15, extract 1 p. Kishinev, 1st August 1929.

The first of these papers deals with a serious outbreak of *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., that occurred throughout Bessarabia in 1929. The moths oviposited on convolvulus and *Atriplex*, and the larvae severely infested beet, lucerne, sunflowers, maize, etc. In the only place in which remedial measures were attempted, a spray of 2 lb. Paris green and 4 lb. lime to 100 gals. water, with flour as an adhesive, gave good results.

In the second paper a popular account is given of measures for the control of *L. sticticalis*. They include spraying with arsenicals, barium chloride (30 lb. to 100 gals. water) or a 9 per cent. kerosene emulsion ; trap ditches ; and deep ploughing to destroy the pupae.

If bonfires are lighted in fields at night, the moths fly into the flames and are killed.

[Mordvilko (A. K.).] **Мордвилко (А. К.). The Root Aphid (*Trifidaphis phaseoli* Pass.) of Cotton, Potato and other cultivated Crops.** [*In Russian.*]—*Ann. Inst. Exptl. Agron.*, vii, no. 3–4, pp. 339–345, 18 refs. Leningrad, 1929.

The geographical distribution and economic importance of *Trifidaphis phaseoli*, Pass. (*perniciosa*, Nevskii) are discussed, and the literature recording its occurrence on various food-plants is reviewed. The character of the damage caused by infestation of the roots to cotton in Transcaucasia is pointed out [*R.A.E.*, A, xvi, 430]. The larvae and alate and apterous parthenogenetic females are described in detail. The infestation may spread through winged virginiparae, which chiefly occur in summer, and the young migrating larvae. It is pointed out that root Aphids may be exules of migrating species, the sexual forms of which occur on their primary food-plants, or they may be anholocyclic forms of migrating species evolved owing to the disappearance of the primary food-plant. Root infestations only occur on secondary food-plants. On the basis of laboratory experiments and observations in the field in the Crimea, the author concludes that *Pistachia mutica* is the primary food-plant of *T. phaseoli*, which has a complete cycle of generations in places where this tree occurs. The Aphids form galls on the edges of the leaves, from which at the end of August or beginning of September alate migrants fly to the roots of various herbaceous dicotyledons, where they hibernate, and in the spring a series of parthenogenetic generations is produced. By the end of April and in May–June nymphs appear and develop into winged sexuparae, which fly to the trunks of *P. mutica*, on which they produce their larva-like sexual offspring. The latter have no proboscis and do not feed, but moult four times, pair, and oviposit in the cracks of the bark, each female laying only one egg. The stem-mothers hatch from these eggs in the following spring and form galls on the bursting buds and young leaves.

At the same time that the sexuparae are produced, reproduction continues on the secondary food-plants. Winged virginiparae may occur, but these can only infest other herbaceous plants. The Aphid can maintain itself exclusively on the secondary food-plants, and it does so in regions where *P. mutica* has disappeared, the sexuparae then becoming superfluous. Should the latter deposit their offspring on a tree other than *P. mutica*, the resulting stem-mothers cannot survive. The sexuparae may occur long after the disappearance of the primary food-plant, but gradually become extinct, so that only alate and apterous exules remain, this anholocyclic form not being able to change back into the holocyclic one.

For the control of the Aphid on cotton clean cultivation is recommended, and plantations should be established as far as possible from waste land. Measures that have been previously suggested are discussed and include drainage of the fields to lower the level of the underground water, as excessive moisture favours the development of the Aphids. After the usual irrigation of the fields before sowing, they should be ploughed to secure a more even distribution of the moisture in the soil ; summer irrigation should be avoided.

[Troitzkiĭ (N. N.).] **Троицкий (Н. Н.). Some Results of a Study of the Comparative Ecology of *Phylloxera* in the U.S.S.R.** [*In Russian.*]—*Ann. Inst. Exptl. Agron.*, vii, no. 3–4, pp. 354–378, 2 figs., 1 map, 6 tables, 5 refs. Leningrad, 1929.

This is a preliminary report on work on *Phylloxera* in the Russian Union in 1927–28. Its distribution is discussed in detail, and a list is

given of vine-growing districts still free from infestation. In recent years it has spread beyond its former northern limits, and new boundaries should, therefore, be established to indicate regions that may be safe from infestation. The resolutions of a recent conference [*R.A.E.*, A, xvii, 478] are briefly reviewed, the author supporting the opinion that American vines should be prohibited in new vineyards in uninfested regions and that the cultivation of hybrids should be encouraged.

The economic importance of *Phylloxera* is discussed, and some phenological data obtained in various districts are given in tables. The depth at which the Aphids occur in the soil usually varies from 4 to 28 ins., but in some districts it is as much as 5½ ft, and in Kuban they were found at a depth of over 15 ft. Hibernation occurs at depths varying from 4 to 18 ins. Instances have been observed of the root forms being killed by the freezing of the upper layers of the soil owing to the absence of snow, and by a rise in the underground water level, after they had remained below it for a considerable time. The development of *Phylloxera* is closely connected with the condition of the vine, as the nutritive elements of the roots and leaves change throughout the year quantitatively as well as qualitatively. Root infestation is most severe about the end of August. The manner in which the Aphids spread is discussed [xiv, 195 ; xvi, 608].

Laboratory experiments show that the most favourable temperature for the larvae is 25° C. [77° F.], and for the eggs about 31° C. [87·8° F.] ; at 34° C. [93·2° F.] the eggs were killed. The activity of the larvae began in spring at 13° C. [55·4° F.], and hibernation occurred when the temperature was lower than 7° C. [44·6° F.]. Various points of difference in the biology of *Phylloxera* in the Caucasus and the Ukraine are discussed ; the optimum temperature in the former area is 23–25° C. [73·4–77° F.], and in the latter 26–28° C. [78·8–82·4° F.]. In the Ukraine, hibernation takes place chiefly on thin roots, whereas in the Caucasus it occurs exclusively on thick ones. From measurements of hibernating larvae the author concludes that two races are concerned, that in the Ukraine being *vitifolii* and that in the Caucasus *vastatrix*. The resistance to infestation of various indigenous types of vines in the Caucasus is discussed, and control measures carried out against *Phylloxera* are briefly reviewed [xv, 125 ; xvi, 608 ; xvii, 308].

[Meĭer (N. F.).] **Мейер (Н. Ф.). On Estimating the Importance of parasitic Hymenoptera in the Biology of noxious Insects.** [*In Russian.*]—*Ann. Inst. Exptl. Agron.*, vii, no. 3–4, pp. 399–404. Leningrad, 1929.

The importance of an extensive study of the value of parasites in the control of insect pests is discussed, and the difficulty of distinguishing between hyper- and super-parasites is pointed out, especially as certain primary parasites may also sometimes act as hyperparasites. The methods and organisation of such a study are briefly outlined. In a survey of the parasites of a given area, records should be made of the times at which they occur, together with the intensity of infestation by them of individual hosts and the particular stage attacked. It should be remembered that most parasites are to be found in greater numbers on a given host on the outskirts of orchards or forests than in the more shaded interior.

[Filip'ev (I. N.).] **Филипьев (И. Н.). Injurious Insects and other Animals in U.S.S.R. in the Years 1921-1924. No. 4. The Winter Cutworm** (*Euxoa segetum* **Schiff.**). [*In Russian.*]—*Trud. prikl. Ent.*, xiii, no. 4, pp. 223–256, 3 maps, 6 refs. Leningrad, 1929. Price 75 *k.* (With a Summary in English.)

This is a detailed review of observations made by various authors in different parts of European Russia between 1921 and 1924 on the bionomics, economic importance, parasites and control of *Euxoa* (*Feltia*) *segetum*, Schiff. Brief notes are given on the districts from which the moth has been recorded, showing the damage caused and the remedial measures applied in each.

[Mordvilko (A. K.).] **Мордвилко (А. К.). Food Plant Catalogue of the Aphididae of U.S.S.R.** [*In Russian.*]—*Trud. prikl. Ent.*, xiv, no. 1, pp. 1–100, 25 figs. Leningrad, 1929. Price 1 *r.* 50 *k.*

The introduction to this work gives a detailed account of the bionomics and biological cycles of Aphids, and contains instructions for the collection and preservation of specimens. The catalogue itself is followed by an index to the plants, but there is no index to the Aphids.

Webster (J. F.) & Dutt (A.). **Sunn Pest (Ergaija) on Cereals in Iraq.**—*Agric. Leafl. Dept. Agric. Iraq*, no. 13, 8 pp., 3 pls. Baghdad, 1926. [Recd. 1929.]

An account is given of the bionomics and control of *Eurygaster integriceps*, Put., on cereals in Iraq [*R.A.E.*, A, xvii, 290, 442, etc.]. Eggs are almost invariably laid in batches of 14. They hatch in about 10 days, and the nymphs are full-grown about 30 days later. Approximately 20 per cent. of the eggs were found to be parasitised by the Proctotrupid, *Telenomus vassilievi*, Mayr, which emerges as an adult in about 20 days, and the propagation and distribution of this parasite is advocated. A small unidentified red mite preys on the eggs, but is not sufficiently numerous to be of economic importance. The removal of weeds on which the eggs are laid [xvii, 290] and the collection of the adults on their arrival and of the resulting nymphs by sweeping the plants with nets are recommended. Harrowing with brush-wood or other light harrows after weeding will shake off and press into the ground the remaining eggs. It is suggested that the pest could be controlled to a considerable extent if wheat-growing in infested areas were discontinued completely for one or two seasons. The growing of barley (which is harvested before the nymphs mature) over the whole area and the burning of the stubble as soon as the crop is harvested would destroy a large proportion of the bugs. The propagation of varieties of cereals, particularly of wheats, that mature early is also recommended.

Aphids.—*Agric. Leafl. Dept. Agric. Iraq*, no. 14, 5 pp., 3 pls. Baghdad, 1927. [Recd. 1929.]

A brief popular account is given of the Aphids that occur on various economic plants and shade trees in Iraq and the means of dealing with them. Those discussed include *Pterochlorus* (*Dryaphis*) *persicae*, Cholod. (?), which is a serious pest, occurring on the bark of peach, *Brevicoryne* (*Aphis*) *brassicae*, L., which is very injurious to cabbage, and an Aphid on pomegranate.

Some of the commoner Garden Pests of Iraq.—*Agric. Leafl. Dept. Agric. Iraq*, no. 16, 5 pp., 4 pls. Baghdad, 1927. [Recd. 1929.]

A brief popular account is given of the bionomics and control of the following insects and mites, which are common pests in gardens in Iraq: *Myiopardalis pardalina*, Big., and *Aulacophora foveicollis*, Lucas, on cucurbits; *Plutella maculipennis*, Curt., on crucifers; a fly, probably *Pegomyia hyoscyami*, Panz., mining the leaves of beet, *Chenopodium* and *Polygonum*; *Tetranychus telarius*, L., on a great variety of food-plants; and *Paratetranychus* (*Oligonychus*) *simplex*, Banks, a serious pest of dates.

Theobald (F. V.). **Some Aphides from southern India, with Descriptions of six new Species.**—*Entomologist*, lxii, nos. 795–796, pp. 177–181, 196–201, 240, 15 figs. London, August–September 1929.

Among the new species described are *Macrosiphum eleusines* on *Eleusine coracana*, *Hyalopterus cari* on *Carum copticum*, and *Oregma mysorensis* on bamboo, all from Mysore.

Carpenter (P. H.) & others. **Handbook of Information, 1929.**—*Indian Tea Ass. Sci. Dept.* [Pub.], no. 1—1929, (revd. edn.) 102+6 pp., 3 maps, 11 pls. Calcutta, 1929.

This handbook contains a tea pest calendar for Middle Assam, enumerating all the pests likely to occur in each month, with notes on their habits and recommendations for their control. An account is also given of the methods of inspecting tea seed for export. The punctures produced in the seed as a result of the feeding of the tea seed bug, *Poecilocoris latus*, Dall., are of some importance, as they permit the entry of fungus infection, etc. This Pentatomid occurs in the tea gardens throughout the year; seeds punctured before they are set probably fail to ripen. A chapter is devoted to instructions for spraying tea bushes.

Kunhikannan (K.). **Administration Report of the Entomological Section for 1927-28.**—*Rep. Dept. Agric. Mysore 1927–28*, pp. 29–34. Bangalore, 1929.

A campaign against *Amsacta albistriga*, Wlk., was conducted in 200 villages, and over 187 thousand moths and over 3 million larvae were captured. The lack of rain in several localities in June and July 1927 prevented serious damage by the jola grasshopper [*Colemania sphenarioides*, Bol.]. Dusting with pyrethrum, and especially with calcium cyanide, is considered effective against mango hoppers [*Idiocerus* spp.], but the cost is prohibitive; a proprietary dust that probably contains pyridine may prove cheaper. The value of removing infested blossoms is discussed [*R.A.E.*, A, xv, 358]. If those appearing in the middle of January are attacked, they should be removed; earlier blossoms, however, are too advanced to become infested when oviposition begins.

It is suggested that the rhinoceros beetle [*Oryctes rhinoceros*, L.] may be controlled on seedling coconut palms by spraying the leaf bases with Bordeaux mixture. Collecting the adult beetles by hand considerably reduced infestation by the coffee borer [*Xylotrechus quadripes*, Chevr.] on two estates. Good results were obtained in the control of the

avare pod borer [*Adisura atkinsoni*, Moore] on 40 acres of avare [*Dolichos*] by rubbing the eggs from the earliest pods, the operation being carried out twice.

Attempts to introduce the lantana fly [*Agromyza lantanae*, Frogg.] from Hawaii to control *Lantana* failed, probably on account of unfavourable temperature conditions.

The Coccid [*Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.)] introduced [from Ceylon] for the control of cactus [*Opuntia dillenii*] has become firmly established, and several plants have been killed. The insect has spread slowly, not more than 30 yards in 9 months, but the rate of spread could probably be increased artificially.

GONGGRIJP (H.). **Combating Mites in Hevea Nurseries.**—*Meded. Algem. Proefst. A.V.R.O.S.*, Rubberser. no. 67, 19 pp., 2 pls.; also *Arch. Rubbercult.*, xiii, no. 2. Batavia, February 1929. (In Dutch and English.)

During the first half of 1928, *Hevea* in nurseries on many rubber estates on the east coast of Sumatra was seriously attacked by *Tarsonemus translucens*, Green, the infestation being quite different from those previously recorded, which were comparatively harmless and of short duration and disappeared after a few showers. To test the relative value of dusting with sulphur and spraying with derris, experiments were made with very finely ground raw sulphur from the Sibajak crater, with derris extract as prepared by the Deli Experiment Station [*R.A.E.*, A, xvii, 346], and with Neoton, which appears to be a concentrated extract of derris [xvii, 547]. The experiments are described in detail. The best and quickest results were obtained with the sulphur applied with a duster used in vineyards in Europe, and at a cost of only one-third to one-quarter that of the other methods. The effect of sulphur is attributed to the formation of volatile sulphur compounds, and as this continues as long as sulphur is present, this substance has a long period of activity, especially in the dry season when attacks by the mites are at their height. Dusting should be repeated when the mites again appear on the young leaves.

VAN DER GOOT (P.). **Eenige dierlijke vijanden van** *Vigna hosei* **en** *Calopogonium mucunoides*. [Some Insect Pests of *V. hosei* and *C. mucunoides*.]—*Landbouw*, iv, no. 12. [Buitenzorg] June 1929; also as *Korte Meded. Inst. PlZiekt.*, no. 11, 16 pp., 4 pls. Buitenzorg, 1929. (With a Summary in English.)

Vigna hosei and *Calopogonium mucunoides* are extensively grown as green manure plants in the Dutch East Indies. Notes are given on the bionomics of a few insects observed on them, none of which is of sufficient importance as a pest to warrant remedial measures. Of these the most common are the Lygaeid, *Chauliops bisontula*, Banks, and the Capsid, *Halticus tibialis*, Reut., *Agromyza* (*Melanagromyza*) *dolichostigma*, de Meij., *A.* (*M.*) *phaseoli*, Coq., and the Eumolpid, *Pagria aeneicollis*, Lef., being only occasionally met with. *Chauliops*, *Halticus* and *Pagria* occur on both *Vigna* and *Calopogonium*, *A. phaseoli* on the former and *A. dolichostigma* on the latter.

DE CASTELLA (F.) & FRENCH (C.). **Mealy Bug** (*Dactylopius longispinus*). **A potential Vine Pest.**—*J. Dept. Agric. Vict.*, xxvii, pt. 7, pp. 427–433, 2 figs. Melbourne, July 1929.

Pseudococcus adonidum, L. (*Dactylopius longispinus*, Targ.) has been noticed for the past few years damaging grapes in a vineyard in the Mildura district of Victoria. This mealybug is common in gardens, and probably spreads from ornamental plants in the vicinity, but the rapid increase among vines indicates that any infestation should be located and promptly suppressed. The occurrence of this mealybug in other countries and on other plants is discussed, and a short life-history is given. The infested bunches of grapes are sticky with honeydew, which dries to a sugary substance mixed with the waxy exudations of the mealybugs and portions of dead insects. These grapes are unmarketable, and if they are dried, they have a whitish appearance easily mistaken for mould. The insects are found in numbers near affected bunches, generally on the lower surfaces of leaves, together with eggs of Chrysopids, which may be predacious on them. The mealybugs were also fairly numerous under old bark on the main stem and branches of the vines, but did not seem to be overwintering under old bark beneath the soil surface. The remedial measures suggested include spraying with nicotine sulphate in summer and the use of a strong contact insecticide in winter, after exposing the bases of the vine trunks. Several formulae for insecticides that have proved successful against similar pests are quoted.

MILLER (D.). **The Bacon-fly.**—*N.Z. J. Sci. Tech.*, xi, no. 1, p. 52. Wellington, N.Z., June 1929.

In view of serious annual losses to the bacon industry in New Zealand caused by the bacon-fly [*Piophila casei*, L.], a brief account is given of its bionomics [*cf. R.A.E.*, A, ii, 572 ; x, 397 ; xv, 324].

ANDERSON (T. J.). **Control of Maize Stalk Borers.**—[*Bull.*] *Dept. Agric. Kenya* [no. 7F of 1929], 5 pp. Nairobi, 1929.

The common stalk borers of maize and millet in Kenya are *Busseola fusca*, Fuller, and *Sesamia calamistis*, Hmps., the former being responsible for about 85 per cent. of the damage done. A history of a successful campaign against the borers in one area is given, the chief measures being the compulsory notification of their presence, the complete destruction of old maize stalks, set dates for planting, the eradication of self-sown maize, and the appointment of inspectors with full powers to deal with infestations, especially in late-planted maize.

JAMES (H. C.). **Biological Control in Kenya Colony with special Reference to the Problem of the Common Coffee Mealybug,** *Pseudococcus lilacinus*, **Ckll.**—[*Bull.*] *Dept. Agric. Kenya* [no. 7E of 1929], 5 pp. Nairobi, 1929.

The introductory portion of this paper constitutes a brief review of the methods employed in attempts to control *Pseudococcus lilacinus*, Ckll., already noticed [*R.A.E.*, A, xiii, 523 ; xvi, 308–311, etc.]. In view of the seriousness of the loss caused to the coffee crop by this mealybug, it has been decided, in addition to retaining the method of

banding against the ants that foster it [xvi, 310], to make renewed attempts to render the aid of predators more certain and effectual. In order to pursue the study of the more promising predators, it is proposed to erect six specially constructed insectaries, where one or more selected species will be produced on a large scale, potato sprouts infested with the mealybug being used as the food-supply.

In addition to *Cryptolaemus montrouzieri*, Muls., it is hoped to adapt the breeding process to some of the indigenous species, the most numerous and effective of which is *Chilocorus angolensis*, Crotch. A brief description is given of the adult and larva of this Coccinellid, which pupates on the leaves and stems of the coffee tree and is therefore not likely to be trapped by ant-repellent bands, and which is large enough to offer considerable resistance to ants. Difficulty has hitherto been experienced in breeding experiments with *C. angolensis*, since the adults devour the mealybugs so quickly that they lay very few eggs in the time available, only small numbers being laid by this species at one oviposition. The eggs hatch in 1–2 days, the larval stage lasts from 3 to 4 weeks, according to the amount of food consumed and the temperature, and the pupal stage 16–19 days. The larvae attack each other if the food-supply is exhausted. The female is capable of laying 100–250 eggs. Experiments will be conducted to discover an artificial food on which the Coccinellids can be reared and bred. One already tested, consisting of eggs, batter and honey, while keeping them alive, inhibits reproduction.

Another indigenous predator is *Hyperaspis delicatula*, Muls., the larva and adult of which are briefly described. This Coccinellid is about the same size as *Cryptolaemus* and may therefore be more adaptable to breeding than *Chilocorus*, but as it crawls down the main stem of the coffee tree to pupate in the soil, it is liable to be trapped in adhesive bands. *Scymnus guttulatus*, Sic., is also present throughout the infested areas and may prove valuable for breeding purposes. Although the incidence of internal Hymenopterous parasites of *P. lilacinus* appears to have recently increased, they are still without significance in controlling the mealybug in Kenya.

HARGREAVES (H.). **Annual Report of the Government Entomologist.** —*Rep. Dept. Agric. Uganda 1928*, pp. 44–45. Entebbe, 1929.

Capsids found on cotton were *Lygus vosseleri*, Popp., *Deraeocoris ostentans*, Stål, *Deraeocoris* sp. (near *oculatus*, Reut.) and *Creontiades ? elongatus*, Leth., the first named being the most common and apparently causing a certain amount of boll shedding. Damage by *Earias* and *Aphis gossypii*, Glov., was general, but *Helopeltis* was uncommon. Slight injury to the leaves was caused by the Lymantriids, *Arctornis rubricosta*, Fawcett, and *Nygmia fasciata*, Wlk., and the Geometrid, *Cleora acaciaria*, Boisd.

Coffee was considerably damaged by *Antestia lineaticollis*, Stål, chiefly in an area where the bug had previously been confined to one estate. In most cases it disappeared when the shade trees were removed, probably owing to the fact that it was no longer protected from the effects of the cold nights that are normally experienced in this region. In other cases the attack was definitely a result of unsuitable methods of cultivation that caused loss of soil and humus, or produced a hard pan of soil, the trees being weak and diseased. Experiments

were again carried out with a sodium arsenite bait [*R.A.E.*, A, xiv, 553] (¾ oz. of the arsenical being used instead of 1 oz.), which proved successful when applied as a mist-like spray. Hand-picking is preferable where labour is suitable, as the bug gradually ceases to be a pest, whereas the use of the bait-spray seems to be constantly necessary when it has once been undertaken, probably because the parasites of the bug are also killed by it. *Stephanoderes hampei*, Ferr., was prevalent on a number of estates, and in several instances it was found that densely shaded parts of the plantations were acting as sources of re-infestation, damage at a distance from such centres being negligible. Towards the end of the year the Bethylid parasite, *Prorops nasuta*, Waterst., became more numerous and exerted increasing control over the pest, but the Braconid, *Heterospilus coffeicola*, Schmied., was not found [*cf.* xiv, 225, etc.]. Minor pests of coffee not already mentioned [xvi, 313] were the Lamiid, *Bixadus sierricola*, White; *Metadrepana* sp., which was parasitised by *Echthromorpha variegata*, Brullé, *Xanthopimpla* sp. and a Chalcid; *Virachola* sp.; and an unidentified Pyralid. *Coccus* sp. was preyed on by the Noctuid caterpillar, *Ozopteryx basalis*, Saalm. The Chrysomelid (Halticid) mentioned in 1925 [xiv, 553] has now been identified as *Jamesonia weisei*, Jac.

Pests of sweet potato were: the Aegeriids, *Aegeria aericincta*, Meyr., and *Tipulomima pyrostoma*, Meyr., observed for the first time boring in the thicker stems; the Curculionid, *Peloropus* sp., also attacking the stems; the Tineid, *Brachmia convolvuli*, Wals.; the Pterophorid, *Ochyrotica concursa*, Wals.; and *Acraea acerata*, Hew., which is parasitised by a species of *Charops* that is itself attacked by an Ichneumonid, *Mesochorus* sp.

Other insects observed were: the Arctiid, *Spilosoma investigatorum*, Karsch, feeding on the leaves of groundnut [*Arachis hypogaea*]; *Argyroploce leucotreta*, Meyr., attacking the cobs of maize and the seed-heads of *Sorghum*; the Jassid, *Cicadulina* (*Balclutha*) *mbila*, Naudé, the vector of streak disease of maize; *Heliothis obsoleta*, F., and *Prodenia litura*, F., attacking the leaves of beans (*Phaseolus*); the Pyralid, *Lamprosema indicata*, F., rolling the leaves of *Vigna*, and *Cydia* (*Laspeyresia*) *campestris*, Meyr., and another species of the same genus injuring the pods; *Argyroploce leucotreta*, attacking the seeds of castor oil [*Ricinus communis*]; *Heliothis obsoleta*, eating the leaves and seed-heads of tobacco; *Dermestes* sp. in dried fish; and the Bostrychid, *Xylopertha crinitarsis*, Imhoff, boring in timber. The parasite of the Lymantriid, *Notolophus vetustus*, Hmps., has been identified as *Apanteles beneficus*, Vier. (*africanus*, Cam.).

Delgado de Torres (D.). **La inspección fitopatológica y su funcionamiento en los Estados Unidos y en el Canadá.** [Phytopathological Inspection and its Working in the United States and in Canada.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 89–105, 25 figs. Madrid, December 1928.

In giving an account of this subject, it is suggested that quarantines against the importation of pests are often established without regard to the fact that special circumstances may prevent the possibility of the introduction of a given pest, and that in some cases it may cost less to combat a pest than to guard against its introduction.

Gómez Clemente (F.). **Aclimatación en España del** *Cryptolaemus montrouzieri* **Muls., para combatir el " cotonet " del naranjo.** [The Acclimatisation in Spain of *C. montrouzieri* against *Pseudococcus citri*.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 106–123, 12 figs., 2 refs. Madrid, December 1928.

In view of the success achieved by the introduction of *Novius cardinalis*, Muls., against *Icerya purchasi*, Mask., in Spain, the Phytopathological Station at Valencia obtained another Coccinellid, *Cryptolaemus montrouzieri*, Muls., from Mentone, for controlling *Pseudococcus citri*, Risso, which is increasing considerably on oranges. The beetle has become established, and good results have already been observed. An account is given of its biology and the methods of breeding and distributing it.

del Cañizo (J.). **Una plaga de los melonares** (*Epilachna chrysomelina*, **Fabr.** [A Pest of Melon Fields.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 124–130, 5 figs. Madrid, December 1928.

The Coccinellid, *Epilachna chrysomelina*, F., is a pest of melons, watermelons, cucumbers, and pumpkins on the Mediterranean coast of Spain, young plants being sometimes killed. It is also found on wild cucurbits. In some parts of the province of Cáceres potatoes have been injured in the absence of cucurbits. The adults leave their winter quarters in spring, and oviposition, lasting a few days, soon begins, each female laying from 150 to 200 eggs. The larvae hatch in 8–10 days and feed on the lower surface of the leaves. There are two generations a year. Control may be effected by spraying with lead arsenate when the larvae first appear.

del Cañizo (J.). **El " gusano " de las manzanas y peras,** *Laspeyresia* (*Carpocapsa*) *pomonella*, **L.** [The Apple and Pear Worm, *Cydia pomonella*.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 150–156, 5 figs. Madrid, December 1928.

Apples and pears are important crops in Spain, but are sometimes severely infested by *Cydia* (*Laspeyresia*) *pomonella*, L., a brief account of the bionomics and control of which is given.

Benlloch (M.). **Estudios sobre nuevas fórmulas insecticidas o modificación de las usuales.** [Studies on new Insecticide Formulae or Modifications of standard ones.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 131–137, 1 graph. Madrid, December 1928.

Lead arsenate is being increasingly used in Spain, but failures occur owing to the defective suspension of the arsenate. This can be corrected to a large extent by the addition of molasses (2–3 per cent. of the total amount of spray). Whether molasses is used or not, it is essential that the lead arsenate be first thoroughly mixed, little by little, with a small quantity of water. The molasses must be mixed separately and diluted with a large quantity of water.

Scorching of vines by calcium arsenate used in sprays against *Haltica ampelophaga*, Guér., has led to tests of various formulae. The usual one (4 lb. anhydrous sodium arsenate, 8 lb. lime, 100 gals. water) did

not give rise to scorching if prepared as follows : The arsenate is mixed in 2–3 quarts of water, and this is added to the lime (mixed in a small quantity of water). The fluid is stirred till quite homogeneous and diluted, again with thorough mixing, to the total bulk required.

Though the Chalcid, *Aphelinus mali*, Hald., destroys considerable numbers of *Eriosoma lanigerum*, Hausm., which is a serious pest of apple in some parts of Spain, a contact spray will always be useful against it. Almost all the commercial formulae require large quantities to be sprayed, the chemical action being supplemented by a mechanical one. As alcohol has wetting and solvent properties, better results are obtained with 8 oz. nicotine (95–98 per cent.), 5 gals. methylated spirits and 100 gals. water.

Delgado de Torres (D.). **Insecticidas a base de nicotina.**—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 160–163. Madrid, December 1928.

This is a description of the various nicotine insecticides. The use of nicotine has hitherto been limited in Spain, but it is now increasing as the cost has been reduced by excise concessions.

González de Andrés (C.). **Aparatos pulverizadores.** [Spraying Apparatus.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 164–178, 27 figs. Madrid, December 1928.

This article describes the various types of sprayers and spray-nozzles now in use.

Trabajos de las Estaciones di Fitopatología agrícola en el año 1928. [Work done by the Stations of agricultural Phytopathology in Spain in 1928.] **Trabajos de las secciones agronómicas relativos a plagas del campo en el año 1928.** [The Work of the agronomical Sections on agricultural Pests in Spain in 1928.]—*Bol. Pat. veg. Ent. agríc.*, iii, no. 12–14, pp. 179–224. Madrid, December 1928.

Brief notes are given on the pests and diseases of plants observed in Spain in 1928 by the various phytopathological stations, etc.

Verguin (J.). **La mouche des olives** (*Dacus oleae*, **Rossi**).—*Rev. Zool. agric.*, xxviii, nos. 2, 3 & 5, pp. 17–27, 37–48, 65–70, 8 figs. Bordeaux, 1929.

An attempt is made to collate published information concerning *Dacus oleae*, Gmel., which regularly causes serious loss to the olive crop on the French Mediterranean coast and in Corsica. The distribution, systematic position and bionomics of the fly are reviewed, and all its stages are described. It would appear that the duration of the life-cycle varies from one to six or seven months and the annual number of generations from one or two to five, depending on the climate. Hibernation occurs in all stages. The sequence of generations in the Alpes-Maritimes and neighbouring districts is discussed, and it is shown that the presence of olives on the trees from April to June is the principal factor in producing outbreaks of the fly, which are more or less severe according to the number of olives present and the extent to which the harvest is delayed. This also accounts for the

biennial occurrence of severe infestations, since when the attack is slight, the crop is large and takes longer to harvest, so that opportunity is afforded for the development of the overwintering generations. The new crop is rapidly destroyed, and no olives are left on the trees after September or October to receive the eggs of adults maturing in the autumn and winter. Only a very few survive to reinfest the next year's crop, and the injury to it only becomes apparent late in the season.

It has been suggested that altitude exercises some influence on the development of the fly, since attacks have been observed to be much more severe on the coast than in more elevated regions. Natural factors that cause its destruction include temperatures persistently below 12° C. [53·6° F.] and prolonged rains causing excessive humidity of the soil, both of which suspend development. All stages are more resistant to extremes of temperature when the degree of humidity is slight. Parasites, predators and bacterial diseases of the fly observed by various authors in different European countries are briefly reviewed. Hymenopterous parasites of the larvae can produce a high rate of parasitism in certain years and are in many cases capable of development on alternative hosts when *D. oleae* is absent.

A comparative account is given of the baits and bait-sprays used by various workers. Their effect depends on the isolation of the olives treated and upon accurate observations of the habits of the flies, the later generations of which, being in excess of the number required for the infestation of a given area of olives, migrate to other olive-yards not yet infested. The dispersal of flies from infested trees to others treated with baits presents a special danger, as the flies arrive on the trees fully fed and deposit their eggs before seeking the poisoned food. The chief condition of success with all artificial control measures is the simultaneous treatment of the whole of the affected district. Although no satisfactory results have yet been obtained in various efforts made to acclimatise exotic parasites of *D. oleae*, it is believed that these endeavours may eventually prove successful.

FAES (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1928. A. Division de physiologie et pathologie végétale.**—*Annu. agric. Suisse*, xxx, fasc. 2, pp. 99–111. Berne, 1929.

The work of the Division for 1928 is reviewed, and various pests of vines and fruit trees are discussed. The situation with regard to *Phylloxera* in the Cantons of Vaud and Valais is summarised. In Vaud the importance of the campaign against it is decreasing as the reconstruction of infected vineyards progresses. *Sparganothis pilleriana*, Schiff. (*Pyralis vitana*, F.) is increasing in one locality. Experiments showed that the percentage of mortality increased regularly with the number of spray treatments applied, and for vineyards regularly attacked by this Tortricid at least two applications of a spray containing arsenic should be made during June at an interval of 8–10 days. The Lygaeid, *Nysius senecionis*, Schill., is recorded as attacking vines in Switzerland for the first time. The weeds on which it was feeding had been cut down and left on the ground to dry, and the bugs abandoned them for the vines. Notes are given on the biology of *Hyponomeuta malinellus*, Zell., on apple [*R.A.E.*, A, xvii, 258].

Faes (H.) & Staehelin (M.). **Les parasites, insectes et champignons, des arbres fruitiers. Résultats des traitements d'hiver, de printemps et d'été effectués au cours de l'année 1928.**—*Annu. agric. Suisse*, xxx, fasc. 2, pp. 125–148, 6 figs. Berne, 1929.

An account is given of experiments with various insecticides and fungicides against pests of fruit trees undertaken in Switzerland during 1928. Winter spray treatments, which should only be carried out every 3–4 years, do not obviate the necessity for treatments during the period of growth. Experiments with various proprietary brands of carbolineum against the eggs of *Lecanium* (*Eulecanium*) *corni*, Bch., *Lepidosaphes ulmi*, L., and *Cheimatobia brumata*, L., led to the conclusion that soluble carbolineum can be recommended for winter treatment. Tests were also carried out with various proprietary brands of adhesive for use on bands against winter moths [*cf. R.A.E.*, A, xvi, 169], of which the most important species in this region are *C. brumata* and *Hybernia defoliaria*, Cl. The bands gave satisfactory results, but must remain adhesive for at least two months (from mid-October to mid-December). Aphids were very abundant in 1928, and 6–8 treatments were generally necessary to control them. Satisfactory results were obtained with pyrethrum soap combined with nicotine, the last application in each case being a combination of soft soap and nicotine. No satisfactory method of control has yet been found for *Contarinia pyrivora*, Riley, which destroyed as much as 50 per cent. of the fruit of some varieties of pears in 1926 and 1927. Experiments were undertaken to find a repellent to prevent oviposition or a solution to destroy the eggs laid on the surface of the flower buds, but the results were inconclusive, largely owing to the absence of infested fruits on untreated trees. As a combined spray against fungi and *Cydia* (*Carpocapsa*) [*pomonella*, L.] on pears, satisfactory results were obtained with an arsenical and copper sulphate, but on certain varieties of apples scorching was observed, and the substitution of lime-sulphur for copper sulphate is therefore recommended when apples are to be treated.

Müller (K.). **Das Verbot der Verwendung bleihaltiger Mittel zur Rebschädlingsbekämpfung.** [The Prohibition of the Use of Lead Insecticides against Vine Pests.]—*Weinbau u. Kellerw.*, vii, pp. 54–56. (Abstract in *Zbl. Bakt.*, (2) lxxix, no. 1–7, p. 151. Jena, 1929.)

The decision of the German authorities to prohibit insecticides containing lead in combating vine pests is considered to be justified. Spraying with lead arsenate against the first generation of the vine-moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] resulted in 0·5–1·07 mg. of lead being found per litre of must, and this was not completely removed with the lees in fermentation. Still larger amounts were found after spraying against the summer generation, which requires more lead.

Lindinger (L.) and others. **Bericht über die Tätigkeit der Abteilung für Pflanzenschutz** [July 1917–December 1928].—*Jber. Inst. angew. Bot. Hamburg*, 1917–24, pp. 121–128; 1924–26, pp. 93–135; 1927, pp. 78–121; 1928, pp. 104–165. Hamburg, 1927–29.

These four reports concerning the activities of the Department for Plant Protection for the State of Hamburg cover the years 1917 to

1928, and include notes on the examination of imported and exported plants and the insects found on them, records of enquiries concerning injurious insects, and accounts of tests of insecticides and various control measures, some of the information given having been noticed from another source [*R.A.E.*, A, ix, 256]. The report for the years 1924–1926 contains (pp. 106–107) notes on the synonymy of a number of Coccids by Dr. Lindinger, which include 8 new names.

Tomczyk (W.). **Beitrag zur Kenntnis von** *Oscinis frit* **L. in der Umgebung von Wilno in den Jahren 1925 u. 1926.** [*In Polish.*]—*Trav. Soc. Sci. Lett. Vilno*, Classe Sci. mat. nat., v, no. 13, (*Trav. Inst. Zool. Univ. Vilno*), 10 pp., 1 pl., 2 refs. Vilna, 1929. (With a Summary in German.)

Oscinella (*Oscinis*) *frit*, L., the adults of which are described, was widely distributed and abundant in the Vilna Government (Poland) in 1925–1926. Brief notes are given on its biology, including records of the times of appearance of the various stages, three overlapping generations occurring in a year. Observations showed that the larvae migrate from one stem to another. The character and intensity of the damage caused to oats and barley is discussed, and notes are given on the resistance of various varieties of oats. The effect of the infestation on the growth of oats and barley is discussed in detail; measurements of the height of infested and uninfested stems showed that the former were considerably taller than the latter, and the author concludes that serious injury is only caused to weak plants retarded in development, and that the attacks of the fly may actually be beneficial to plants under optimum conditions of development, as their growth is accelerated, and taller haulms, with a greater number of grains in the ears, are produced.

To determine the ability of the larvae and pupae to survive in the soil after it had been ploughed, infested stems of self-sown cereals and couch grass [*Agropyrum repens*] were buried in the ground at depths of about 2½ and 4½ ins. in October and dug out at the end of April. The stems of the cereals and the larvae they harboured were completely decomposed, whereas the couch grass was sprouting and the larvae in it showed no sign of injury; the pupae were not affected in either case, and they subsequently produced adults.

[Savzdarg (E.).] **Савздарг (Э.). The Raspberry Weevil** *Anthonomus rubi* **Hbst. on Strawberry and Raspberry and its economic Importance.** [*In Russian.*]—*Sad i Ogorod*, 1929, no. 5, pp. 17–27, 2 figs. Moscow, 1929.

Anthonomus rubi, Hbst., is an important pest of strawberries and raspberries in the Moscow Government. The overwintered adults emerge from the soil at the beginning of May; supplementary feeding for 2–3 weeks is required prior to oviposition, the weevils puncturing the petioles and feeding on the stamens of unopened flower buds. The oviposition period sometimes lasts as long as 7 weeks, most of the eggs being laid about the middle of June and the weevils dying in July. A single egg is deposited among the stamens of each bud, not more than one being laid in a day. The largest buds are preferred, and as the pedicel is partly cut by the female, the infested bud soon drops to the ground. Under artificial conditions *A. rubi* also infested blackberries

and *Geum rivale*. The egg stage averages 7 days, and the larval stage 23; the larva feeds inside the bud on the ground and pupates in it. The pupae are numerous early in July, the pupal period lasting 7–11 days. The young weevils puncture the leaf-stems of raspberries, strawberries and some weeds and also feed on pollen; the summer feeding period is short, however, as most of them enter the soil at the end of July for hibernation.

Early varieties of strawberries suffer considerably more than late ones. When the raspberry buds begin to develop, the weevils readily migrate to them and infest them until the formation of the buds on late varieties of strawberries; in this way raspberries occupy an intermediate stage between the two types of strawberries, and should not be planted near the latter. The method of tying up raspberry bushes in the shape of a fan, although beneficial to the crop, renders the buds more exposed to the weevils and should be avoided when they are prevalent.

In experiments, the application of paradichlorobenzene or naphthalene to the soil as a repellent against the hibernating adults was not effective, and paradichlorobenzene did not kill the larvae in fallen buds. Bundles of straw to trap the weevils when about to hibernate only caught negligible numbers. Crop rotation and improving the resistance of the plants by careful selection of seedlings and clean cultivation are recommended. The causes of the resistance of certain varieties of strawberry and raspberry should be studied.

[Бекман (Yu. I.).] **Бекман (Ю. И.). Observations on the Introduction of Seed Pests.** [*In Russian.*]—*Izv. prikl. Ent.*, iv, pt. 1, pp. 151–166, 1 fig., 6 refs. Leningrad, 1929. (With a Summary in German.)

Notes are given on the bionomics, distribution, food-plants and economic importance of 28 species of insects found alive in seeds imported to Leningrad in the course of the last five years. The following species already occur in some part of the Russian Union: *Sitotroga cerealella*, Ol., found in wheat and maize from North America; *Calandra zea-mais*, Motsch., in wheat and maize from Mexico and Cuba; *C. granaria*, L., in wheat and maize from various other foreign countries; *Bruchus pisorum*, L., in peas (*Pisum sativum*) from India, Spain, Italy, Central America and Cuba; *B. pisorum* var. *sparsus*, F., in *P. arvense* from Ceylon; *B. rufimanus*, Boh., in broad beans (*Vicia faba*) from Italy, Spain, Morocco, Egypt and Asia Minor and peas from Spain; *B. dentipes*, Bdi., in *V. hyrcana* from the Transcaspian region and *V. faba* from Afghanistan; *B. rufipes*, Hbst., in *V. sativa* from Transcaucasia; *B. lentis*, Fröl., in lentils (*Lens esculenta*) from the Crimea and Caucasus; *B.* (*Acanthoscelides*) *obtectus*, Say (*obsoletus*, Say) in beans (*Phaseolus vulgaris*) from Egypt and South America; *B.* (*Bruchidius*) *halodendri*, Gebl., in *Glycyrrhiza echinata* from Afghanistan; *Tribolium confusum*, Duv., in *Sorghum* from Egypt; *Gnathocerus cornatus*, F., in maize from Colombia; *Rhizopertha dominica*, F., in maize from India, wheat from Egypt and *Sorghum* from the United States; *Niptus hololeucus*, Fald., in seeds from Mexico; *Tenebroides mauritanicus*, L., in maize from Italy and *Sorghum* from America; and *Silvanus* (*Oryzaephilus*) *surinamensis*, L., in wheat from Sardinia.

The following pests do not occur in Russia: *Platyedra gossypiella*, Saund., found once in cotton seed from America; *Pagiocerus zeae*,

Egg., in maize from Colombia ; *Calandra oryzae*, L., in various seeds from tropical and subtropical countries ; *Bruchus ervi*, Fröl., in lentils from Tripoli ; *B. ulicis*, Muls. & Rey, in *Vicia ervilia* from Asia Minor ; *B. ulicis vavilovi*, subsp. n., which is described from *V. ervilia* from Afghanistan, and is considered an eastern race ; *B.* (*Callosobruchus*) *chinensis*, L., in *Phaseolus aureus* from southern Afghanistan and lentils, *Cajanus indicus*, *Dolichos lablab*, *Phaseolus mungo*, *Cicer arietinum*, *Vigna oligosperma* and *V. sinensis* from India ; *B.* (*C.*) *quadrimaculatus*, F., in *C. arietinum* from Cuba ; *B.* (*C.*) *phaseoli*, Gyll., in broad beans from India ; *B.* (*C.*) *dolichosi*, Gyll., in *Dolichos biflorus* from Afghanistan ; *Pseudopachymerus lallemanti*, Mars., in *Acacia farnesiana* from Tripoli ; and *Spermophagus subfasciatus*, Boh. (of which *S. pectoralis*, Sharp., is considered a synonym), in beans from Peru and Mexico.

The author points out that there exist biological and ecological distinctions between *Bruchus* (s. str.), *Callosobruchus*, *Bruchidius*, and *Acanthoscelides*, which in his view justify their being treated as distinct genera.

Shtakel'berg (A. A.).] **Штакельберг (А. А.). On a new Pest of Safflower, *Chaetorellia carthami* sp. nov. (Diptera, Trypetidae) from Turkestan and some other Species of the same Genus.** [*In German and Russian.*]—*Izv. prikl. Ent.*, iv, pt. 1, pp. 225–229, 3 refs. Leningrad, 1929.

Chaetorellia carthami, sp. n., is described as a pest of safflower (*Carthamus tinctorius*) from the neighbourhood of Tashkent, and the characters distinguishing it from *C. succinea*, Costa (*conjuncta*, Beck.), the synonymy of which is discussed and with which it was previously confused, are indicated. A revision of Hendel's key to the Palaearctic species of *Chaetorellia* is given.

[Makaryan (M. Ya.).] **Макарян (М. Я.). *Phylloxera* in Armenia.** [*In Russian.*]—*Vestnik Vinod. Ukrain.*, xxx, no. 9, pp. 523–529. Odessa, September 1929.

A brief account of the history of viticulture in Armenia is given, and the result of a survey to ascertain the distribution of *Phylloxera* is discussed, showing the infested and uninfested districts. The former are not numerous and are isolated by chains of high mountains and plateaux on which vines are not grown.

The measures carried out in Armenia since 1927 consist of the disinfection of the imported seedlings and grafting stock, the establishment of quarantine regulations within the country, and a study of the adaptability of American vines to local conditions.

Valov (N.). **Poisoned Baits in the Control of Grasshoppers in Siberia.** [*In Russian.*] 40 pp., 7 figs. Novosibirsk, Sibir. Sta. Plant Prot., 1928.

The most numerous and injurious grasshoppers in Siberia are *Chorthippus* (*Stauroderus*) *scalaris*, F.W., *C. albomarginatus* DeG., *Gomphocerus sibiricus* L., and *Arcyptera microptera*, F.W. The control measures now used against them consist almost entirely of poisoned baits. As bran and molasses are not easily obtainable in Siberia, experiments were made to discover other suitable materials

for preparing the baits ; in 1919 it was found that horse or cow dung, or even sawdust, can be used instead of bran, while it was demonstrated at an earlier date that molasses can be left out altogether. The dung, which must be free from straw, is dried in the sun and passed through a sieve. Sodium arsenite is dissolved in a little hot water, and then diluted with cold, at the rate of 1 lb. to 3 gals. water, and thoroughly mixed with 35 lb. dung. If Paris green is used instead of sodium arsenite, at least 2 lb. are required.

The same proportions are used in preparing baits with dry sawdust. The poison solution poured over the sawdust must be very hot, and the preparation should be compressed for 1–2 hours, so that it becomes thoroughly soaked.

The bait should be broadcast over the infested areas as evenly as possible ; 35 lb. are sufficient for 2½ acres. A more economical method is to scatter it in strips, leaving spaces from 14 to 21 ft. wide between them. The younger the grasshoppers, the narrower should the free strip be, but as the younger larvae have little tendency to move about, there is always a danger that they may not find the bait before it ceases to be effective.

It is important to scatter the bait round cultivated fields, forming protective strips at least 20 ft. wide, the bait being renewed as required.

Misra (C. S.) & Lamba (Karam Singh). **The Cotton White-fly (*Bemisia gossypiperda*, n. sp.).**—*Bull. Agric. Res. Inst. Pusa*, no. 196, 7 pp., 2 pls., 1 ref. Calcutta, 1929.

The Aleurodid, *Bemisia gossypiperda*, sp. n., all stages of which are described, was first noticed on cotton in 1905 at Pusa. Recently it has become a serious pest of cotton, particularly in the Punjab, broad-leaved varieties suffering most. The eggs are laid on the lower surfaces of the leaves, one female depositing 28–35 and several ovipositing on the same leaf. They hatch in 24 hours, and all the larval stages are passed on the plant ; in cases of severe infestation, the lower surfaces of the leaves are completely covered with the larvae, and as a result of the loss of sap the leaves fall off, the bolls remain half opened and the quality of the lint deteriorates. The pupae also occur on the lower surface of the leaves. The Aleurodids reach their maximum development by the end of August, when the majority of the plants become infested. Over 500 larvae and pupae were found to the square inch on leaves of *Hibiscus esculentus* and 260 larvae on those of cotton. The total life-cycle from egg to adult lasts 12–17 days in August and September (average temperature 84° F. and humidity 87 per cent.). A list of 25 alternative food-plants of this whitefly is given. They include egg-plant (*Solanum melongena*) and Cape gooseberry (*Physalis peruviana*), on which it breeds in large numbers, as well as potato and a variety of cultivated crucifers and cucurbits. Two species of Chalcid parasites have been obtained from the pupae, but the degree of parasitism is only 4–6 per cent. The measures suggested include the planting of trap crops in March and April and burning them before the cotton is sown ; sowing cotton as late as possible to escape the period of maximum infestation ; the evolution of immune types of cotton ; sowing short-leaved varieties in place of the more susceptible broad-leaved ones ; spraying the fields so as

to wet the lower surfaces of the leaves when the plants are 12–14 ins. high ; and the introduction of parasites and predators. The immature stages and both sexes of the adult are described.

Light (S. S.). **On a Caterpillar attacking Albizzia Seedlings.**—*Tea Quarterly, J. Tea Res. Inst. Ceylon*, ii, pt. 3, pp. 105–108, 1 pl. Nuwara Eliya, August 1929.

The Geometrid, *Macaria pluviata*, F., which is widely distributed in Ceylon, was found attacking two nurseries of *Albizzia* seedlings about the middle of September 1928. The larvae fed chiefly on the tender leaves, destroying the growing point and killing many of the plants. Their presence is detected with difficulty, since they take up a position on the under side of the leaf-stalks, which they closely resemble. From 10 to 30 were taken from each bed (6 sq. yds.) of seedlings every morning while fine weather prevailed, but none was found on *Albizzia* trees in the field. About 50 per cent. control was secured by spraying with 1 lb. Paris green to 50 gals. water, the results being calculated 24 hours after the application. One laboratory application of Paris green and lime, 1 : 4, to foliage of *Albizzia* that had been lightly sprayed with water resulted in 60 per cent. control after one day and 90 per cent. after two days. Repeated applications of spray are recommended, except in the case of small nurseries, in preference to dusting, which requires a much larger amount of Paris green.

All stages of the moth are described, and brief notes on its life-history and distribution are given. *Albizzia* appears to be the only food-plant. The larval stage lasts 3–4 weeks and the pupal stage 14–23 days ; adults confined in cages lived 5–6 days without food. The older larvae were always found singly on plants. Pupation takes place in the soil, in the laboratory not more than 1 in. below the surface, the pupa rising to the surface before the emergence of the adult. The eggs are laid singly or in clusters, mainly on the buds and youngest leaves, and hatch in 5–6 days. A Braconid, all stages of which are briefly described, is a parasite of the young larva. The cocoons of the parasite are always found near the tip of a bare leaf-stalk. The degree of control exercised by it is indicated by the fact that 90 caterpillars and 45 parasite cocoons were collected from the beds in one day. The parasite emerges from the cocoon after 9–10 days and lives 3–4 days in captivity. A Chalcid is parasitic upon the pupa of this Braconid. A single pupa of *M. pluviata* was found containing the puparium of a Tachinid.

Ishida (M.). **Researches on the Parasite of *Oregma lanigera*, Zehnt., *Encarsia flavoscutellum*, Zehnt., in Java, with an Account of its Introduction into Formosa.** [*In Japanese.*]—*Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 38, 138 pp., 2 pls. Taihoku, March 1929.

The Aphid, *Oregma lanigera*, Zehnt., is very injurious to sugar-cane in Formosa, and no parasite having been found there, attempts were made in 1924 and 1926 to introduce *Encarsia flavoscutellum*, Zehnt., from Java. Numerous parasitised hosts on cane leaves kept in ice boxes at a temperature of 12–18° C. [53·6–64·4° F.] were brought to Formosa, but only a few parasites were alive on arrival, owing to the length of the journey. Parasites bred at Hongkong, however, were

successfully introduced, and large numbers were liberated in the field. *E. flavoscutellum*, a description of which is given, is very common in Java, where it kills about 50 per cent. of the Aphids. The adult parasites emerge chiefly in the early morning and live only 4 or 5 days. The females outnumber the males. From 1 to 6 eggs, with an average of 2, are laid in one host. The egg, larval and pupal stages last 2–4, 5–10 and 6–11 days respectively.

SONAN (J.). **On the scientific Name of** *Stenobracon maculata*, **Mats.** [*In Japanese.*]—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 102, pp. 333–334. Taihoku, June 1929.

Stenobracon maculata, Mats., of which *Macrocentrus javanicus*, Ishida, is a synonym, is parasitic on the larvae of *Chilo infuscatellus*, Snell., *Scirpophaga nivella*, F. (*auriflua*, Zell.) and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) in Formosa.

NAKAYAMA (S.). **The more important Insect Enemies of the Rice Crop in Chosen.**—*Ann. Agric. Expt. Sta. Chosen*, iv, no. 4, pp. 248–250. Suigen, Korea, August 1929.

Chilo simplex, Butl., is the only rice borer occurring in Korea, where it is widely distributed and has two generations a year. *Trichogramma japonicum*, Ashm., and *Phanurus* (*Ceraphron*) *beneficiens*, Zehnt., are parasitic in the eggs. The more important rice hoppers include *Delphacodes* (*Liburnia*) *furcifera*, Horv., *D.* (*L.*) *oryzae*, Mats., and *Nephotettix apicalis* var. *cincticeps*, Uhl. They mostly attack the lower leaf sheaths and have four or five generations a year, being abundant in summer and autumn. They can be controlled by oiling the water in the rice field and shaking them from the plants so that they fall into it. The Pyralid, *Bradina admixtalis*, Wlk., appears in large numbers in certain years. The larvae live inside the leaves, which they fold lengthwise. There are two or three generations a year, hibernation taking place in the larval stage in the stubble. Lead arsenate is recommended against this moth and also against *Oxya velox*, F., which appears in enormous numbers in late summer and early autumn. The Noctuid, *Naranga aenescens*, Moore, has about three generations a year, the larvae feeding on the leaves. *Cirphis* (*Siderides*) *unipuncta*, Haw., chiefly infests Italian millet [*Setaria italica*], but also attacks rice, wheat and maize, having two generations a year. *Donacia lenzi*, Schönf., has one generation a year, hibernating in the larval stage. The larvae attack the roots of rice, but the adults feed on weeds. *Lema tristis*, Hbst. (*flavipes* Suffr.) is fairly common, attacking the leaves in the adult and larval stages. There is one generation a year, and the damage is most severe on higher ground. Collecting the eggs and adults by hand in the early morning is recommended.

YOKOYAMA (K.). **Studies on the Japanese Dermestidae. II. Morphology and Biology of** *Anthrenus* (*Nathrenus*) *verbasci*, **L.** [*In Japanese.*]—*Rep. Seric. Expt. Sta.*, vii, no. 9, pp. 425–476, 2 pls. Tokyo, August 1929.

This paper is the second of a series [*cf. R.A.E.*, A, xiv, 141]. The larvae of *Anthrenus verbasci*, L., which is widely distributed in Japan, feed on dried animal matter such as skins, silk, etc., causing serious

damage. There is only one generation a year, hibernation taking place as a mature larva. Pupation occurs in April, and the adults emerge 20–30 days later. The males live about 30 days, and the females about 40–50. They are not very active and are found out of doors on flowers. Mating takes place 10 days after emergence, and the females begin to oviposit indoors 5 or 6 days later, the egg-laying period lasting 1 or 2 weeks, during which time 20–100 eggs may be laid by one female. They hatch in 25 or 26 days, the larvae appearing from June to the beginning of July. Infested materials should be fumigated with hydrocyanic acid gas, etc., or heated at a temperature of 125° F.

Murata (T.) & Hirano (I.). **On the Leafhoppers (1).** [*In Japanese.*] —*J. Plant Prot.*, xvi, pp. 518–528. Tokyo, 1929.

Over 60 species of Fulgorids and Jassids are known to infest rice in Japan, the more important being *Delphacodes* (*Liburnia*) *striatella*, Fall., *D.* (*L.*) *furcifera*, Horv., and *D.* (*L.*) *oryzae*, Mats. The duration of the immature stages of these three species varies with the temperature; in the case of *D. striatella*, the eggs hatch in 6–25 days, and the adult stage is reached 10–31 days later. The adults may live as long as 14 weeks. Hibernation takes place in the nymphal stage among grasses, and the adults begin to appear at the end of March. There are 4–7 generations a year, and one female may lay over 600 eggs.

Ito (N.). **Studies on** *Phaedon brassicae*, **Baly (1).** [*In Japanese.*]— *J. Plant Prot.*, xvi, pp. 537–541. Tokyo, 1929.

The Chrysomelid, *Phaedon brassicae*, Baly, which is widely distributed in Japan, feeds on various cruciferous vegetables, sometimes doing serious damage. There are two generations a year in the field, though three have occurred in captivity, hibernation taking place in the adult stage. One female lays 15–20 eggs a day, and these hatch in 5–7 days. The larvae mature in about 10 days. They moult twice and pupate in the ground, the pupal stage lasting a week.

Tamanuki (K.). **Studies on** *Luperodes praeustus*, **Motsch. Preliminary Report.** [*In Japanese.*]—*Rep. Karafuto Agric. Expt. Sta.*, pp. 1–24, 3 figs. Konuma, Sakhalin, July 1929.

The Galerucid, *Luperodes praeustus*, Motsch. (*nigripennis*, Motsch.) is one of the most important pests of various vegetables in Sakhalin, including soy beans [*Glycine hispida*], *Brassica* spp., *Arctium lappa* and carrot, and also attacks clover (*Trifolium*), etc. There is one generation a year, hibernation taking place in the egg stage. The larvae first appear at the beginning of June and pupate in 15–20 days. The pupal stage lasts about a week, the adults emerging from July onwards. They begin to feed in 27 hours and oviposit 12 or 13 days after emergence. The males live 25–30 days, and the females 35–40. They are active and drop to the ground when disturbed. The eggs are laid singly on the ground round the food-plants, especially clover, from the end of July until September. One female oviposits several times and may lay as many as 50 eggs. No insect enemies have been observed but the larvae are killed by a fungus. Spraying with derris is recommended against the larvae.

Monzen (K.). **Studies on some Gall-producing Aphids and their Galls.** —*Saito Ho-on Kai Monog.*, no. 1, pp. 1–80, 17 pls. Sendai, May 1929.

Forty-two species of Aphids from Northern Japan are dealt with in this work, of which eight are described as new. *Eriosoma ulmi japonicum*, Mats., hibernates in the egg stage on *Ulmus*. The stem-mothers appear in May, causing the leaves to curl, and the winged forms of the third generation migrate to an unknown summer host. *Tetraneura ulmifoliae yezoensis*, Mats., hibernates on *Ulmus japonica* in the egg stage, but migrates to *Panicum* spp. in the spring. *Prociphilus kuwanai*, Monzen, hibernates in the egg stage on pear. The stem mothers appear in May, causing the leaves to curl, and the spring migrants leave the galls in the middle of June for an unknown host. *Myzus sasakii*, Mats., produces galls on the upper surface of the leaves of *Prunus serrulata* and migrates to its summer host, *Artemisia vulgaris*, in June. *Chermes japonicus*, sp. n., produces galls on *Picea jezoensis* var. *hondoensis*. *Phylloxera vastatrix*, Planch., is injurious to vines in almost all the grape-growing districts of Japan, producing galls on the leaves and roots. *Aphis uwamizusakurae*, sp. n., causes leaf-curling on *Prunus grayana*, and *Macrosiphum sumomocola*, sp. n., on *P. salicina*.

Yokoyama (K.). **On *Anthrenus pimpinellae*, F., an imported Species?** [*In Japanese.*]—*Insect Wld.*, xxxiii, no. 6, pp. 183–186. Gifu, June 1929.

The Dermestid, *Anthrenus pimpinellae*, F., has been very common for the past two or three years near Tokyo, having probably been imported from Europe. The adults and larvae were found in a sparrow's nest, and the former were also seen on mulberry flowers. There is one generation a year, but some individuals have a two-years' life-cycle.

Okajima (G.). **On the Distribution in Japan of Insects injurious to the Rice Plant with special Reference to their Presence in adjacent Parts of the Orient.**—*Proc. 3rd Pan-Pacific Sci. Congr. Tokyo, 1926*, pp. 2050–2067. Tokyo, 1929.

In Japan, 157 species of insects are known to attack rice, of which 40 are indigenous to Japan proper, 91 seem to be of southern origin and 13 of northern origin. A list of all the species is given, showing their distribution throughout the world.

Kishida (K.). **On the Rat, *Apodemus speciosus giliacus*, Thomas.**
Kojima (T.). **The Feeding-habits of *Spodiopsar cineraceus*, Temm.** [*In Japanese.*]—*Oyo-Dobutsugaku Zasshi*, i, no. 1, pp. 38–40, 40–42. Tokyo, August 1929.

Eighteen Cerambycids were found in the stomach of *Apodemus speciosus giliacus* in Sakhalin. *Spodiopsar cineraceus* also feeds on insects, etc.; of those found in these birds, 49 per cent. were injurious species, including *Oxya* sp. and *Chilo simplex*, Butl., and 6·5 per cent. were beneficial, the remainder being of no economic importance.

KOJIMA (T.). **The Habits of** *Batocera lineolata*, **Chevr.** [*In Japanese.*] —*Oyo-Dobutsugaku Zasshi*, i, no. 1, pp. 43–45. Tokyo, August 1929.

The Lamiid, *Batocera lineolata*, Chevr., attacks oak and chestnut (*Castanea*) in Japan, preferring trees that are more than 30 years old. The beetles appear from the middle of June to the middle of July, the life-cycle being completed in two years. An Encyrtid is parasitic on the eggs.

FULLAWAY (D. T.). **Report on the Use of Rice Straw as a Packing Material in the Orient.**—*Hawaii. For. Agric.*, xxvi, no. 2, pp. 81–82. Honolulu, April–June 1929.

Rice straw is used extensively in the Orient as a packing material, but as several Lepidopterous pests hibernate as mature larvae or pupate in the bored stems, this material may be instrumental in the importation of pests into Hawaii and California. During a visit to Japan, the author found *Chilo simplex*, Butl., *Schoenobius bipunctifer*, Wlk., *Sesamia* (*Nonagria*) *uniformis*, Ddgn., and *Naranga diffusa*, Wlk., in the hollow stems of rice plants. These moths are important pests of rice in Japan and other oriental countries, and will attack other grasses and even sugar-cane on occasion. The Noctuid, *N. diffusa*, is not a stem-borer, and its presence in this situation indicates that other species of this group, many of which are important pests, might use rice, barley or wheat straw as a convenient shelter for hibernation or pupation. The Hawaiian Government has placed an embargo on rice straw since the discovery of *C. simplex* in the rice-fields of Hawaii. The author does not consider that the fumigation in Japan of goods packed in rice straw would obviate the danger, since the hibernating larvae are very resistant to insecticidal gases, the fumigating equipment is insufficient, no satisfactory plan has been put forward for the supervision of the fumigation, and the fumigation of goods packed in places remote from the ports where the fumigating plants operate cannot be undertaken. He therefore suggests the use of sawdust or wood shavings for packing instead of rice straw, although their cost is somewhat higher and greater care in making up the packages to avoid breakage is necessary.

WHITNEY (L. A.). **Reports of the Associate Plant Inspector, February-April 1929.**—*Hawaii. For. Agric.*, xxvi, no. 2, pp. 93–96. Honolulu, April–June 1929.

The pests intercepted are not dealt with in detail, but those mentioned include : *Monacrostichus citricola*, Bezzi, in lime fruits, and larvae of *Acythopeus aterrimus*, Waterh. (black orchid weevil), from the Philippines ; *Chilo simplex*, Butl., in rice straw from Japan ; *Rhizopertha dominica*, F. (lesser grain borer), from Fiji ; and *Pseudococcus gahani*, Green, on persimmon fruits from California.

BOSELLI (F. B.). **Studii sugli Psyllidi (Homoptera : Psyllidae o Chermidae). V. Descrizione di un nuovo genere di Psyllidi di S. Domingo (Antille).**—*Boll. Lab. Zool. Portici*, xxiv, pp. 70–77, 6 figs. Portici, 1929.

The Psyllid, *Euceropsylla russoi*, gen. et sp. n., is recorded from *Inga vera*, a leguminous tree used as shade for coffee in San Domingo.

Wolcott (G. N.). **The Mystery of** *Alabama argillacea.*—*Amer. Nat.*, lxiii, no. 684, pp. 82–87. New York, N.Y., January–February 1929.

The problem of the origin of the annual outbreak of *Alabama argillacea*, Hb., in the cotton fields of the United States is discussed. It is possible that this moth does not hibernate and that its appearance each year is the result of a fresh invasion of the moths from the tropics. The conditions in Brazil may, perhaps, be suitable for the continued existence of the moth throughout the year. In Peru, *Anomis luridula* Guen. (*texana*, Riley) occurs on cotton in all the coastal cotton-producing valleys, but *Alabama argillacea* is found only in the warmer valleys, where the temperature and irrigation make possible an almost continuous cotton crop, observations showing that the larvae do not appear at temperatures below 60–65° F. Apparently, when the nights begin to get cold, the moths do not oviposit, and eventually die unless they happen to fly towards warmer regions and fresh cotton fields. Such migrating moths are possibly responsible for the first generation of larvae that appears in the cotton fields of the West Indies and the southern United States. Similarly, it is possibly the first cool nights in Haiti and Texas that start the reverse flights of moths, which re-infest the cotton fields of northern Peru. If, however, there is some central, tropical region, where the larvae find a constant food-supply and are present throughout the year, it is difficult to explain what stimulus starts the moths on their flights to distant cotton regions and to the even more distant regions where it is too cold for cotton.

Notice of Permit Requirement for Entry of Chestnuts and Acorns from foreign Countries.—1 p. Washington, D.C., U.S. Dept. Agric., P.Q.C.A., August 1929.

On account of the risk of entry of *Cydia* (*Carpocapsa*) *splendana*, Hb., *Curculio* (*Balaninus*) spp. and other pests, chestnuts and acorns may be imported into the United States only under permit, from 1st September 1929.

Information re Sterilization outside of the State of Florida of Citrus Fruits under Mediterranean Fruit Fly Regulations.—*U.S. Dept. Agric., P.Q.C.A.*, no. 247, 2 pp. mimeographed. Washington, D.C., 27th September 1929.

Supplementary information is given as to the methods of handling *Citrus* fruit for sterilisation by cooling outside Florida as a precaution against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in accordance with the provisions of previous instructions [*R.A.E.*, A, xvii, 662].

Diehl (H. C.), Ezell (B. D.) & Ryall (A. L.). **Relation of some Factors in Spraying and Cleaning Practices to Efficiency of Removal.**—*Proc. 34th Ann. Mtg. Idaho Hort. Ass.*, pp. 25–33. Boise, Ida., 1929.

The various methods for removing spray residue from apples are further discussed [*R.A.E.*, A, xvi, 598]. A modified type of box dip, in which the depth of immersion necessary has been reduced, has proved satisfactory, but for apples with open calyx tubes the immersion type of

equipment should be avoided. Various means of warming the acid cleaning solutions are discussed. An extensive series of experiments was undertaken to obtain further information as to the effect of the use of oils in combination with lead arsenate in cover sprays upon the ease with which the fruit is cleaned at harvest time, but although various suggestions are put forward as a result of these tests, no final conclusions were reached. In the use of oils with lead arsenate, efforts should constantly be directed towards a reduction of the amount of lead arsenate employed. It would seem that this may be attainable, as successful control of the larvae has been obtained using half strength lead arsenate sprays, and as better control is said to result from the use of a combination of oil and lead arsenate than from lead arsenate alone. The object, in so far as fruit cleaning is concerned, is increased efficiency and greater probability that the fruit will eventually satisfy the world tolerance without exceptional difficulty.

WAKELAND (C.). **Some Results from Oil Emulsion Sprays for Codling Moth Control in 1927 and 1928.**—*Proc. 34th Ann. Mtg. Idaho Hort. Ass.*, pp. 64–77. Boise, Ida., 1929.

During 1927 and 1928, experiments were carried out in Idaho to test oil sprays alone and in various combinations with a view to discovering a substitute for, or a means of reducing the amount of, lead arsenate in sprays so that the arsenical residue may be economically decreased. It was found that certain combinations of oil and lead arsenate or of oil, nicotine sulphate and lead arsenate were more effective in controlling the codling moth [*Cydia pomonella*, L.] than lead arsenate alone, but were more expensive. The greatest percentage of sound fruit was obtained in 1927 with lead arsenate (3 lb. to 100 U.S. gals.) in the calyx and four cover sprays, whereas in 1928 the best results were obtained with 2·4 lb. lead arsenate to 100 U.S. gals. water with the addition of $\frac{3}{4}$ per cent. oil in five cover sprays, the calyx spray being of lead arsenate alone. In some cases increased cost is justified by the greater percentage of sound fruit produced. Oil or oil and nicotine also reduce infestation by certain other insects and may sometimes be added with advantage to one or more of the codling moth treatments on this account. It is pointed out that oil sprays are still in the experimental stage, and growers are recommended to make thorough and timely applications of lead arsenate and then to remove the residue by washing.

SPULER (A.). **More Efficient Codling Moth Control.**—*Proc. 34th Ann. Mtg. Idaho Hort. Ass.*, pp. 100–111, 8 refs. Boise, Ida., 1929.

In spite of the marked improvements in spraying machinery and in insecticides, the problem of controlling the codling moth [*Cydia pomonella*, L.] in the State of Washington is greater at the present time than it was 20 years ago. Continuous orchard plantings and crowded tree conditions have enabled the moth to spread rapidly, and orchards not sprayed or inefficiently sprayed become a constant source of re-infestation. The fact that greater concentration of sprays and heavier and more frequent applications have been constantly necessary to maintain control indicates the possibility of a resistant strain of *C. pomonella* being developed [*cf. R.A.E.*, A, xvii, 365].

The effectiveness of spray treatment depends on the timing and thoroughness of applications, and the number of larvae to be combated.

The importance of the calyx spray (which should be applied when approximately 80 per cent. of the petals have fallen and before the calyx lobes have closed) is emphasised, for although it may be applied several weeks before any eggs hatch, it is the only means of applying poison to the calyx cup, which is a vulnerable point of attack. The proper timing of cover sprays is essential, and the value of bait traps in this connection is pointed out. The bait formulae recommended are 1 gal. malt syrup or molasses (with enough yeast to start fermentation) in 19 gals. water, or 1 U.S. gal. apple juice, 1 lb. brown sugar and 1–2 cakes of yeast [*cf. R.A.E.*, A, xv, 592]. Moths entered the traps whenever temperatures at dusk were conducive to flight and oviposition (60° F.), and as in spring the eggs normally hatch within 10–16 days, the first cover spray should be applied within this period from the time when the traps begin to show a steadily increasing catch of moths.

Even with high pressure and large amounts of material, satisfactory results are seldom obtained if the trees interlock and the spray for apples in the upper part of the tree has to be forced through the lower branches ; in these cases thoroughness of application depends largely on proper pruning and tree removal. Experiments indicate that placing bait traps throughout an entire orchard not only results in a marked reduction of injury, but also in a subsequent saving of at least one application of lead arsenate in the first year ; during the second year the number of sprays may be still further reduced, and in this way the problem of arsenical residue may be largely eliminated. Once the infestation has been reduced to 1 per cent. or less, a few sprays may suffice to give practical control in the following year. If baits are employed, the whole orchard should be treated, since the use of a few traps may attract enough moths from the neighbouring trees to produce a greater infestation than if the traps were not used, as many moths lay a few eggs before entering the traps. In localities where a few lead arsenate sprays give successful control, the extra expense of moth traps is not advisable.

One of the chief disadvantages of lead arsenate spray is its failure to protect fruit under conditions of severe infestation, and in order to overcome this growers have increased the amount of lead arsenate in the spray and the number of applications, thus magnifying the problem of arsenical residue. Experiments to determine the relative efficiency of lead arsenate used at rates of 2 and 4 lb. to 100 U.S. gals. indicate, when viewed from a commercial standpoint, that very little is to be gained by using dosages greater than 2 lb. once commercial control has been attained, but that in severe infestations more lead arsenate or supplementary measures or both should be used to reduce the number of larvae going into hibernation. Spreaders such as casein-lime, soap, glue, etc., have been added to lead arsenate to improve its covering powers, but the use of casein-lime at Wenatchee has never increased the insecticidal value of the spray. With regard to the effect of drying and semi-drying oils on the adhering powers of the spray, tests with fish-oil in 1928 showed that the insecticidal value of the lead arsenate was so improved that the arsenate could be reduced to half the standard amount used, fruit sprayed with 1 lb. lead arsenate to 100 U.S. gals. water with the addition of fish-oil showing slightly less injury than that sprayed with 2 lb. lead arsenate to 100 U.S. gals. water. Other arsenical and non-arsenical sprays tested all proved less effective than lead arsenate. Oil sprays alone did not give satisfactory results in the field, and their real value in the control of *C. pomonella* appears

to be as carriers for other insecticides. Nicotine sulphate used alone was not effective, but the results obtained in field tests with a combination of nicotine sulphate and oil proved it to be as effective as lead arsenate or more so. Owing to the high cost of the material and possible injury to fruit and trees, this combination is not recommended for more than two or three treatments, which should be made when most of the eggs of the first and second broods are being laid. The combination of oil and lead arsenate is very effective, but leaves a heavy deposit on the fruit that is difficult to remove, and when it is used, the number of applications or the concentration of the lead arsenate should be reduced.

Wicks (W. H.). **Codling Moth Control.**—*Proc. 34th Ann. Mtg. Idaho Hort. Ass.*, pp. 111–113. Boise, Ida., 1929.

In Idaho the loss of fruit due to infestations by the codling moth [*Cydia pomonella*, L.] ranges from practically nothing in some orchards to as much as 50 per cent. in others, and records over many years show that at least 15 per cent. of the apple crop is annually rendered unmarketable on account of injury by this pest. Moreover, since all apples must meet the arsenical residue tolerance of 0·01 grains of arsenic per pound of fruit for foreign markets and 0·02 grains for domestic markets, still further losses must be attributed to *C. pomonella*. Accurate observations on the activities of the moths are essential if spraying is to be carried out at the proper time; failure to spray at the right moment, even when the application is made with the greatest care, always results in a high percentage of infested fruit. The number of sprays and the time of application varies in different orchards and in different localities and should be determined by each individual grower. For determining the date of emergence and the number of moths present, moth traps containing bait [see preceding paper] should be hung in the upper part of the trees. Fermentation should have started before the bait is diluted. New material can be added to the supply as long as fermentation is active, and the pots should be kept one-half to two-thirds full. To determine the number of larvae present, treated bands were placed round the trunks of the trees, and both home-made bands of crêpe paper and a corrugated, commercial band gave 100 per cent. mortality without apparent injury to the trees, the crêpe paper band usually killing the sheltering larvae within 24 hours. To prepare the home-made band, 1 lb. beta naphthol (technical grade) is mixed with 1½ U.S. pts. lubricating oil (red engine type) and heated until the naphthol dissolves; bands of crêpe paper four inches wide are then immersed in the solution until they are thoroughly saturated. The solution is evenly distributed and dries rapidly. The cost of these bands, exclusive of labour, is about a penny a tree. All rough bark should be removed before the bands are placed in position.

McGregor (E. A.). **The True Cricket—a serious Cotton Pest in California.**—*Circ. U.S. Dept. Agric.*, no. 75, 8 pp. Washington, D.C., July 1929.

Serious losses are caused to cotton in California by the cricket, *Gryllus assimilis*, F., which sometimes renders re-planting of seedlings

necessary. Many kinds of green foliage, particularly lucerne, tender stems or other succulent vegetable matter are also used as food. The crickets, which hibernate in all stages, are present everywhere from early April until frosts begin; they are to be found in cotton fields throughout the growing season. The greatest numbers usually occur during July, August and September. The broods are not very distinct, but apparently the spring generation from overwintering eggs appears about 1st May and requires about 11 weeks for development, and the second about 8; there is only a partial third generation. Hibernating adults are merely quiescent and feed to a limited extent during the warmer intervals. Cotton is attacked on the stem and foliage. In very young plants, the stem is usually severed just above the ground; in plants from 3 to 8 inches high, the stems are gnawed irregularly, often on both sides so that they easily break off; in taller plants the apical buds are frequently severed from the stem. The attack on cotton is most likely to occur in fields where cotton follows a winter crop of grain, especially barley, as the soil of barley fields is covered with cracks and is not cultivated until the wintering crickets have emerged, and the cotton is planted late. The total number of eggs deposited by one female is not known; probably more than one egg-mass is deposited, and under favourable conditions in the laboratory the average progeny from one egg-mass is about 75. The method of oviposition is described. The incubation period in late August and early September is from 8 to 14 days. There are very few natural enemies, a large red mite of the genus *Euthrombidium* being probably the only important one; several birds feed on the crickets.

The planting of cotton after cereals should be avoided wherever possible. Frequent cultivation will eliminate crevices, etc., in which the crickets shelter in the daytime, and the borders of cotton fields should be cleared of weeds. As crickets have been caught in numbers by ordinary lanterns placed over pans containing water and kerosene, it is suggested that light-traps placed about cotton fields would destroy large numbers, and poisoned baits should also be very successful.

Cory (E. N.) & Eaton (N. A.). **Insecticidal Value of Pyrethrum Soaps.**—*Bull. Maryland Agric. Expt. Sta.*, no. 308, pp. 417–428. College Park, Md., April 1929.

Experiments have been made with various insects to test the toxic value of two proprietary pyrethrum soap insecticides, both of which are based on the alcoholic oleoresin made by the usual process of percolation and concentration. One of these, made by mixing approximately 40 per cent. oleoresin with 30 per cent. soap, proved effective at various concentrations against *Aphis spiraecola*, Patch, *Brevicoryne* (*A.*) *brassicae*, L., *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., *Myzus persicae*, Sulz., *Trialeurodes* (*Asterochiton*) *vaporariorum*, Westw., *Epilachna corrupta*, Muls., *E. borealis*, F., *Galerucella luteola*, Muls., *Diabrotica duodecimpunctata*, F., and *Crioceris asparagi*, L. Against *Hyphantria cunea*, Dru., apple foliage was sprayed with the insecticide before the larvae were placed on the branches, and 100 per cent. mortality resulted. In the case of *Pseudococcus citri*, Risso, two sprayings were necessary. When this insecticide and nicotine sulphate (40%) were used in the same dilutions, the former

gave the higher mortality against *Macrosiphum sanborni* and the latter against *Myzus persicae*. The second insecticide, consisting of 4 per cent. oleoresin, 47 per cent. oleic acid soap (sodium oleate) and 49 per cent. water, was not so fully tested; it appeared effective against Aphids (*A. spiraecola*) but not against Coleoptera.

Inman, jr. (M. T.). **Sulfonated Oxidation Products of Petroleum as Activators.**—*Indust. Engng. Chem.*, xxi, no. 6, pp. 542–543. Easton, Pa., 1st June 1929.

As a result of four years' study on the application of oxidation products of petroleum to the control of insect pests, a definite procedure for their use against soft-bodied sucking insects, such as Aphids and leafhoppers, has been developed. It was found that the efficiency of nicotine sulphate was greatly increased by the addition of chemically treated oxidation products of Pennsylvania gas oil. Where these oxidation products were added at the rate of 1 : 200 to nicotine sulphate spraying solutions, a satisfactory kill was obtained with only one-third to one-fifth of the amount of nicotine commonly employed when soap is used as a spreader. Chemically treated oxidation products of this group have been termed "activators" in view of the fact that they increase the efficiency or activation of an insecticide by bringing about certain physical changes in the resultant spray mixture. A spray mixture containing nicotine or similar toxic material should be of such chemical and physical structure as to reach and enter the tracheae of an insect. The function of an activator is to bring about these results, that is, to wet the foliage and the insect's body effectively and carry the toxic materials to the vital parts, and at the same time to exhibit in itself strong toxic properties.

Both laboratory and field tests have been carried out with activators and toxic substances combined with them under varying conditions, and although several emulsions of oxidation products are promising, the product formed by the following process has given most satisfactory and consistent results in field tests. Sulphuric acid is added slowly to the oxidation products of a straight distillate of Pennsylvania crude oil of 38° Bé. (oxidised gas oil), the mixture being cooled by means of a water jacket. The reaction mixture is then decomposed with water, this removing the excess sulphuric acid and hydrolising a large percentage of the sulphonates and all the sulphates. After settling, the dilute acid is drawn off. The product is subsequently neutralised with sodium hydroxide and allowed to settle to remove the salt solution. The activator produced contains about 40 per cent. oxygen and about 1·5 per cent. sulphur, and has been held for varying lengths of time at 50° C. [122° F.] and — 18° C. [0° F.] without evidence of chemical change. It is a clear, maroon-coloured liquid, easily miscible with water, with which it forms an opalescent emulsion. A 1 per cent. emulsion of the product is itself toxic to various Aphids, leafhoppers and red mites. The concentration of nicotine sulphate commonly used in the proportion of 1 to 800 with soap as a spreader may be reduced to as low as 1 to 4,000 when 0·5 per cent. of the activator is substituted for the soap. Tests indicate that other highly toxic materials, such as pyrethrum, can also be made more efficient by using an activator.

Hoerner (J. L.). **A Progress Report on the Testing of Sulfonated Oxidation Products of Petroleum for their Insecticidal Properties.**—*Bull. Maryland Agric. Expt. Sta.*, no. 310, pp. 449–465. College Park, Md., June 1929.

During 1927 a method was developed for sulphonating the oxidation products of petroleum that rendered the material miscible with water without the use of stabilisers. At the same time experiments indicated that sulphonated oxidised kerosene had some value as a contact insecticide. Later it was found that greatly reduced dilutions of nicotine could be rendered effective against Aphids by the addition of sulphonated oxidised gas oil in place of the usual spreaders [see preceding paper]. Experiments were therefore carried out to test the practicability of this combination. Tests were first made as to the toxicity of the products themselves on two species of Aphids, and it was found that the sulphonated oxidation products of gas oil gave consistently better results than those prepared from oxidised kerosene. The differences between the gas oil samples were small, but " Penetrol," the oxidised gas oil sulphonated by the direct method, in which the unreacted hydrocarbons are not removed [see preceding paper], was a little more effective than the oxidised gas oil sulphonated by the extraction method, in which the oxidation products were separated from the unreacted hydrocarbons by two successive sulphuric acid treatments, the sulphonated compounds from the two treatments being combined, hydrolised with water and neutralised with sodium hydroxide.

Numerous experiments were next undertaken with combinations of Penetrol and oxidised gas oil sulphonated by extraction with different commercial forms of nicotine against 29 different species of Aphids, and the results showed that nicotine can be used effectively at a much greater dilution with Penetrol than with soap, the activation or increase in efficiency being more strikingly shown with the more resistant species. Similar results were also obtained against thrips and leafhoppers. Combinations of Penetrol with lead arsenate, Bordeaux mixture, Paris green and flowers of sulphur caused no injury to apple foliage, and combinations of nicotine sulphate and Penetrol with lead arsenate, with Bordeaux mixture and with flowers of sulphur were slightly more effective against Aphids than nicotine sulphate and Penetrol alone. The addition of Penetrol had no apparent influence on the effect of lead arsenate against chewing insects. Experiments indicate the possibility that it increases foliage injury caused by lime-sulphur in summer sprays on apple, but in a delayed dormant application this combination appears to be safe, and effective against Aphids.

Although the results with combinations of Penetrol and pyrethrum varied somewhat, a number proved satisfactory against Aphids with a much greater dilution of pyrethrum than is usually recommended. In this combination, pyrethrum extracts alone appeared to give much more consistent results than pyrethrum preparations containing soap. Concentrated benzene, petroleum ether and acetone extracts formed the most stable stock solutions when used with Penetrol, but the insecticidal efficiency of these combinations has not yet been determined. A few tests were also carried out with Penetrol and a sulphonated oxidised kerosene (from which the organic acids and aldehydes had been removed before sulphonation by the extraction method) in combination with paradichlorobenzene against *Aegeria*

exitiosa, Say, and *Phloeotribus* (*Phthorophloeus*) *liminaris*, Harr., and with carbon bisulphide against Lamellicorn larvae, and although the results are not sufficiently extensive to be conclusive, they indicate the desirability of further work. Penetrol was tested on various plants, shrubs and trees, and it was found that in general no injury was caused at concentrations considerably higher than those necessary for the control of Aphids. Penetrol alone was found to be toxic to several species of Aphids at 1 per cent. concentration, whereas ½ per cent.was toxic to Aphids when combined with nicotine, 1 part to 4,000 or 5,000 parts by volume.

SEVERIN (H. H. P.). **Curly Top Symptoms on the Sugar Beet.**—*Bull. California Agric. Expt. Sta.*, no. 465, 35 pp., 4 pls., 13 figs., 5 refs. Berkeley, Cal., March 1929.

The symptoms of curly-top of beet are discussed with the object of facilitating the recognition of the disease. Perfectly healthy beets may show the inward rolling of the margins of the youngest leaves, which is one of the earliest symptoms. Various types of abnormalities in beet foliage that are often confused with curly-top are briefly described, including those produced by mosaic disease, which is not transmitted by *Eutettix tenella*, Baker, the vector of curly-top. Mosaic may sometimes be confused with injury to sugar-beet caused by *Empoasca flavescens*, F. The symptoms of curly-top that are characteristic and plainly visible are a transparent network of minute veins on the youngest and innermost leaves in the early stages and wart-like protuberances on the veins on the lower surfaces of the leaves in the later stages. The symptoms on the roots and on seed beet are also described. An outline is given of the practical application of the diagnosis in estimating the percentage of curly-top in a given field. Severe losses may be avoided by stopping further agricultural operations when a severe outbreak of curly-top occurs. When *Eutettix tenella* is present in maximum numbers, the percentage of curly-top that develops depends upon the number of adults on each beet, the crop being likely to fail if one adult is present to 20 beets when the adults invade the fields in spring before or immediately after thinning [*R.A.E.*, A, xi, 8]. The number of leafhoppers present can be determined by disturbing the foliage while the observer crawls along the row of beets on hands and knees. Beets planted during March and April in a natural breeding-ground of *E. tenella* are usually a failure and will not respond to irrigation when a high percentage of curly-top occurs. Early-planted diseased beets growing in rich sandy soil usually respond to irrigation unless the outer leaves become badly sun-scorched, better results being obtained by repeated light furrow irrigations than by the flooding method. Beet fields in which a high percentage of curly-top is present before or shortly after thinning should be ploughed under and the fields replanted with other crops.

BURGESS (A. F.). **Federal Gypsy Moth Work in Massachusetts.**—*Ann. Rep. Commiss. Conserv. & State For. 1928*, Pub. Doc. no. 73, p. 20. Boston, Mass. [1929.]

The increase in numbers of the gipsy moth [*Porthetria dispar*, L.] recorded in Massachusetts during 1927 [*R.A.E.*, A, xvi, 551] has

continued during 1928, and very strenuous efforts will be necessary to prevent the moth increasing in the territory west of the Connecticut River to a point where heavy defoliation will result and conditions become favourable for rapid spread. Parasitism has been low and climatic conditions favourable for the moth ; importations of parasites from Europe are being continued. The brown-tail moth [*Nygmia phaeorrhoea*, Don.] has not increased to any unusual extent ; it can usually be satisfactorily controlled by destruction of the webs during the winter.

Entomology and Parasitology.—*Rep. California Agric. Expt. Sta., 1927–28*, pp. 32–35 & 70–77. Berkeley, Cal., 1929.

Against *Oecanthus niveus*, DeG. (snowy tree cricket) on raspberries, a single application of 70 per cent. sodium fluosilicate and 30 per cent. diatomaceous earth, at the rate of 50 lb. to the acre, gave complete control in 15 days. The application should be made between the first and second crops, while there are few or no berries on the bushes, and after dusting no berries should be picked for 10–14 days, during which time such berries as are on the bushes ripen and drop off, leaving clean ones to come on later. Sodium fluosilicate was also tried against adults of *Typophorus* (*Paria*) *canellus*, F., which are very injurious to the foliage of raspberries in the late summer, but although good results were obtained in cages, it was not so successful in the field. Studies of *Anthonomus eugenii*, Cano, as a pest of pepper [*Capsicum*], have shown six generations to develop from 15th June 1927 to 1st January 1928. The weevils hibernated in numbers on *Solanum nigrum*, and eggs were deposited in the berries about 15th April ; this plant, therefore, should be removed before the winter. Applications of from 6 to 8 lb. calcium arsenate dust repeated several times prevent damage. Chillie peppers dusted after the pods are about 1 in. in length are washed in a 2 per cent. solution of commercial hydrochloric acid before drying to remove the arsenical residue ; pimento peppers have the arsenic removed in the canning process.

In orchards that were not irrigated and suffered from drought, *Tetranychus pacificus*, McGregor, was observed (apparently for the first time) to injure prunes and almonds. Summer oil sprays are recommended against this mite. Damage to apples by the leaf-roller, *Tortrix* (*Archips*) *argyrospila*, Wlk., has been greatly reduced by dormant oil sprays followed by arsenical sprays in the " pink " and " calyx " periods. Against *Cydia* (*Carpocapsa*) *pomonella*, L., bait traps have been successfully employed to indicate moth activities as a means of timing sprays. Good results have been obtained against *Hyalopterus arundinis*, F. (mealy plum aphis) in early summer by a spray of 7 lb. fish-oil soap to 200 U.S. gals. water. The possibilities of the use of dormant oil sprays to destroy the overwintering eggs on plum and prune trees are being investigated.

Cicadula sexnotata, Fall. (six spotted leafhopper) is known to transmit yellows disease of asters and the identical yellows disease of celery to these and many other plants [*R.A.E.*, A, xvii, 282]. The leafhoppers fly into the cultivated areas after pasture vegetation becomes dry on the plains and foothills. Adults of the spring generation were common during March in fields of barley and oats adjacent to the foothills, but during mid-April, after the grain begins to ripen, they fly to other food-plants. Further dusting experiments against *Diabrotica soror*, Lec.,

and *D. trivittata*, Mann., on cucurbits [*R.A.E.*, A, xv, 628] showed that as good results were obtained with hydrated lime or gypsum alone as with these dusts combined with arsenicals. Very little scorching from lime occurred nor was there any noticeably stimulating effect from the gypsum.

During the year, colonies of the Coccinellids, *Chilocorus bipustulatus*, L., and *Exochomus quadripustulatus*, L., were introduced from Italy; the former survived in lemon groves through the winter, but the latter has not been recovered. In addition to the parasites of *Pseudococcus gahani*, Green [*R.A.E*, A, xvii, 392], minor beneficial insects introduced from Australia were the Coccinellids, *Orcus australasiae*, Boisd., *Leis conformis*, Boisd., and *Coccinella transversalis*, F., which are being propagated for colonisation in the *Citrus* groves. No satisfactory measure has been devised against the orange pests, *Tortrix citrana*, Fern., and *Holcocera iceryaeella*, Riley; the former has been controlled to some extent by a high percentage of natural parasitism. The Tortricid, *Platynota chiquitana*, Barnes & Busck, which is present in California, has been doing heavy damage to grapefruit in Arizona.

Coad (B. R.), Folsom (J. W.) & Gaines (R. C.). **Cotton Louse Control.**—*Leafl. U.S. Dept. Agric.*, no. 53, 4 pp., 1 fig. Washington, D.C., August 1929.

A brief popular account is given of the method of controlling *Aphis gossypii*, Glov., on cotton by dusting with nicotine sulphate. A home-made ball mill for mixing the dust is described.

Ries (D. T.). **Two Iris Insects.**—*Bull. Amer. Iris Soc.*, July 1929, pp. 27–46, 15 figs. Ithaca, N.Y., 1929.

The Noctuid, *Macronoctua onusta*, Grote (iris borer), which, in addition to causing serious direct injury to iris plants, permits infection with soft rot caused by *Bacillus carotovorus*, is probably distributed throughout Canada and the United States. Its present recorded distribution is indicated. Much of the information on its bionomics obtained in New York and Pennsylvania from 1924 to 1928 is similar to that recorded in Indiana [*R.A.E.*, A, xvii, 39].

Several larvae may start work in the same plant, but only one remains at the end of the season, the others having probably migrated to other rhizomes. The plant does not always show signs of attack even when the borer has been at work for several weeks, but the whole central sheath can be easily pulled out and the base will show distinct traces of mining. About the middle of August the larvae leave the roots to pupate in the soil. The pupal stage lasts about a month, though some of the pupae are said to overwinter. There is only one generation a year in New York. All stages of the moth are briefly described, and a list is given of species of iris subject to attack.

Control measures discussed include hand-picking and burning over of the iris plantings in late autumn or early spring, neither of which proved entirely satisfactory. Four or five applications against the young larvae, made at 10-day intervals, of a spray consisting of 1 oz. lead arsenate to 1 U.S. gal. water with the addition of 1 oz. casein or fish-oil soap gave about 90 per cent. control. Control of the pest has

been secured with various soil fumigants, but these have proved injurious or even fatal to the plants, particularly carbon bisulphide, although Cory obtained good results with an emulsion of this material [xvii, 197]. Promising results have been obtained with pyrethrum spray used as a dip, and a solution of $\frac{1}{8}$–$\frac{1}{4}$ oz. calcium cyanide to 1 U.S. gal. water, applied round the base of the plants with a watering can, appeared to kill the borers without injury to the plants. The practice of resetting irises every three years is effective if the trimmings are carefully collected and burned to prevent any of the larvae from migrating to the newly planted roots. Probably the most effective measure is to examine plantings in late July or early August and, wherever frass is found at the base of the plant, to dig up the rhizome and extract the borer, the cleaned root being sprinkled with mercury bichloride (1 : 1000) to protect it against possible infection from soft rot. A description is given of the parasites, *Apanteles militaris*, Walsh, and *Amblyteles jucundus*, Brullé, reared from the larvae in Indiana [xvii, 39]. Among other records of Dipterous and Hymenopterous parasites, many of which are undetermined, two reared by Cory in Maryland have been identified as *Amblyteles brevicinctor*, Say, and *A. jucundus*.

Larvae of *Argyroploce* (*Olethreutes*) *hebesana*, Wlk. (verbena bud moth) were found within the seed-pods of iris in the spring of 1927. The synonymy and distribution of this Tortricid are discussed, all its stages are described, and a list of its numerous food-plants is given. Larvae found on 18th June pupated within the pod two days later, after cutting a small hole in it, leaving only the epidermis intact. The first adults emerged on 2nd July, and the first eggs were laid on the 4th. The eggs are deposited singly or in small batches on the surface of the pod, the number laid by a single female being probably 75–100. The eggs hatch in 3–12 days, and the larvae feed at first on the surface and then usually penetrate into the pod. Occasionally as many as six occur in a pod. The larval period lasts 20–23 days, and the entire life-cycle in New York State occupies 43–47 days, at least four generations occurring each year, with considerable overlapping. The larvae of the fourth usually feed on the leaves, spin cocoons on the approach of cold weather and either pupate or hibernate as larvae among several leaves tied together.

Two applications of a spray consisting of 1 lb. lead arsenate, 1 lb. casein and 25 U.S. gals. water, the first soon after the pods had developed and the second 8–10 days later, gave satisfactory results. A third spray was applied 10 days after the second in the case of a severe infestation. Dusting with sulphur or sodium fluosilicate also gave good results. Other measures include clean cultivation and placing bags over the pods to protect them from injury.

FLUKE (C. L.). **The known Predacious and Parasitic Enemies of the Pea Aphid in North America.**—*Res. Bull. Wisconsin Agric. Expt. Sta.*, no. 93, 47 pp., 50 figs., 42 refs. Madison, Wis., June 1929.

This comprehensive review of the natural enemies of *Macrosiphum* (*Illinoia*) *pisi*, Kalt., in North America is based on studies begun in Wisconsin in 1924 and carried on for three years, a preliminary report of which has already been noticed [*R.A.E.*, A, xiii, 514]. Work by other authors is cited throughout the paper in discussing the various

species involved. Details are given of the methods of study and equipment used, as well as a list of the 76 known predacious and parasitic enemies of *M. pisi* in North America, the chief groups of which, in order of their importance, are Syrphids, Coccinellids, fungous diseases, *Aphidius* spp. and Chrysopids. A study of the initial infestations of the Aphid and the natural enemies that are the chief factors in its control will aid in the prediction of serious outbreaks. Abundance records show, however, that parasites must be present in very large numbers if *M. pisi* is to be effectively held in check. The biology of the various groups attacking the Aphid is discussed, and it is pointed out that whereas the fungus, *Entomophthora aphidis*, if cultured and distributed early in spring, might produce beneficial results, little reliance can be placed on it on account of its dependence on weather conditions. Whereas the Chrysopids usually appear too late in the season and predacious Rhynchota are either too small or prefer other insects for food, the Coccinellids are very easily reared, so that the most effective species can be easily introduced into new localities, and hibernating adults can be transported into infested fields early in the spring. Several species of Syrphids are particularly beneficial and should be fostered. A key, based on the posterior respiratory organ only, to the Syrphid larvae attacking *M. pisi* is given, with brief notes on a number of the individual species including descriptions and biological data. The planting of shrubs and trees which annually harbour Aphids is one of the best methods of developing Syrphids in adequate numbers. Wild raspberry, dogwood, golden rod and roses are among the best types for the purpose, and they will in turn attract aphidiphagous Syrphids. *Syrphus* (*Scaeva*) *pyrastri*, L., which is recommended for introduction into Wisconsin, is a strong flier and abundant in the far west, where it destroys many Aphids. The Syrphids are often heavily infested by parasitic Hymenoptera. The Hymenopterous parasites of *M. pisi*, although generally distributed over the country, are not numerous enough to control it.

HINDS (W. E.) & SPENCER (H.). *Trichogramma* **Experiments in 1928 for Control of the Sugarcane Borer.**—*J. Econ. Ent.*, xxii, no. 4, pp. 633–636, 1 ref. Geneva, N.Y., August 1929.

The breeding of *Trichogramma minutum*, Riley, for the control of *Diatraea saccharalis*, F. [*R.A.E.*, A, xvi, 508] in Louisiana has been continued, and in 1928 more than 16 million of these parasites were obtained. Of these, 257,000 were released in April and 258,000 in June in fields of maize and sugar-cane when the moths were ovipositing. In the first instance eggs of the first brood were found to be parasitised, but the parasites disappeared before the moths again began to oviposit, since the host eggs were unusually scarce. In the second case the percentage of parasitism was considerably greater. A table is given showing the colonisation data and results obtained at intervals during the growing season. By late autumn nearly 100 per cent. parasitism occurred both in fields where *T. minutum* was released and in the control areas. As the parasites spread slowly, liberation from the windward side of the field is recommended. It is suggested that they should be liberated on several successive dates rather than all at once, and should be well distributed over the area selected in lots of two or three thousand to a small section.

Steiner (L. F.). **Codling Moth Bait Trap Studies.**—*J. Econ. Ent.*, xxii, no. 4, pp. 637–648, 3 refs. Geneva, N.Y., August 1929.

In 1927 and 1928, in Indiana, various baits for *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) were tested in enamel pans of 3 U.S. qts. capacity. Aromatic chemicals, of which ethyl propionate was the most attractive, were of no value when used alone. In the spring the results obtained from a solution of molasses and aromatic chemicals were not appreciably better than those obtained with molasses alone; in the summer the addition of 1 cc. geraniol or citronellal per pan rendered the molasses twice as attractive. A 10 per cent. molasses solution was usually employed, sometimes with the addition of yeast to hasten fermentation. Though tin cans proved more attractive than enamel pans during the early part of the season, their attractiveness decreased as they became rusty. A small hole punched in the pans below the rim allowed any excess of liquid to escape without carrying the moths with it. The method of hanging the bait containers on the trees so that they can be lowered for examination is described.

Counts in July of apples of one variety showed only a very slight reduction in infestation in a baited as compared with an unbaited area, indicating that bait traps are of little if any value during the emergence of the spring brood. Counts at harvest of three varieties showed that the average percentages of sound fruit in the baited area were 94·8, 91·45 and 95·72 respectively and in the unbaited area 93·12, 88·4 and 94·08. The total cost of baiting for one year was estimated at approximately £17, and only 80 more bushels of sound fruit were produced. The relative prevalence of the sexes in the orchard probably varies in accordance with the temperature, females being more numerous during the summer months. Although about 95 per cent. of the females captured contained a part or all of their eggs, it is concluded that many eggs were laid before the moths reached the traps. The importance of hanging the pans as high on the trees as possible and in well exposed positions is pointed out; better results were obtained from those that were hung on trees in the higher parts of the orchard. Unless the trap was exposed, more eggs were laid on baited trees than on those with no bait.

Other insects captured in the traps were *Cotinis nitida*, L., *Cirphis unipuncta*, Haw., *Sphecius speciosus*, Dru., and *Glischrochilus* (*Ips*) *fasciatus*, Ol., molasses alone proving very attractive to the last-named. Molasses and geraniol bait was particularly attractive to *C. nitida*, over 20,000 of these beetles being captured in about eleven weeks in 1927 and 1928. Ethyl propionate in a honey and sugar solution was attractive to Elaterids.

Steiner (L. F.). **Miscellaneous Codling Moth Studies.**—*J. Econ. Ent.*, xxii, no. 4, pp. 648–654. Geneva, N.Y., August 1929.

In experiments in Indiana with bands treated with beta-naphthol (1 lb. to 1½ U.S. pints lubricating oil) only 3 per cent. of the larvae of the codling moth [*Cydia pomonella*, L.] found under the bands produced adults. It was observed, however, that these bands repelled 10–20 per cent. of the larvae as compared with untreated ones. Alpha-naphthylamine tested on a very small scale in a similar manner gives promise of being as effective as beta-naphthol. It is considered that of the

chemically treated bands, those made from corrugated strawboard are the best, as they appeared to attract the greatest number of larvae and caused the least injury to the trees. A combination burlap and kraft paper is more efficient than burlap, crêpe or tar paper, where untreated bands are used. Thickness was found to be an important factor in determining the efficiency of any banding material, since most of the larvae passed over the thinner materials.

Of a number of mature codling moth larvae liberated during the day under the overhanging branches of a tree at various distances from the trunk, about 75 per cent. found the trunk within an hour. At night, however, the larvae wandered at random. Of larvae experimentally compelled to hibernate away from the trunk, in lots of 100 in various situations, 60 survived in leaves, 38 in straw mulch, 6 in turf and only 2 in bare, clay-loam soil. Larvae do not, however, hibernate in these places if they are able to find more suitable quarters on trees or shrubs, or in rubbish. The importance of keeping the orchard free from rubbish and weeds is pointed out ; broken branches and loose bark should be removed from the trees. Larvae survived in buried apples for at least seven weeks, and before the soil was too solidly packed could escape from a depth of six inches.

Flint (W. P.) & Goff (C. C.). **Banding for Codling Moth Control.**— *J. Econ. Ent.*, xxii, no. 4, pp. 675–679. Geneva, N.Y., August 1929.

Experiments in Illinois in 1927 and 1928 to test the effectiveness of different types of bands in controlling the codling moth [*Cydia pomonella*, L.] indicated that a light proof paper, either of tar or tar interlined, or burlap faced, is much superior to burlap ; tables are given showing the number and the percentage of larvae collected from various bands. In experiments with bands treated with chemicals toxic to the larvae, the best results were obtained by using beta-naphthol dissolved in benzene and then added to lubricating oil (instead of being dissolved in the heated oil) ; this mixture on corrugated paper caused slight but not permanent injury to the trees. Although mixtures of one part monochlornaphthalene in ten parts of lubricating oil and the same amounts of orthotoluidine gave better killing results, serious injury occurred where these materials were used with crêpe paper bands and were allowed to remain on the trees for 5 months.

Haseman (L.) & Burk (V. F.). **A Determination of the lethal Dosage of Arsenic for Missouri and Colorado Codling Moth Larvae.**— *J. Econ. Ent.*, xxii, no. 4, pp. 655–656. Geneva, N.Y., August 1929.

Previous work on the resistance of strains of codling moth larvae [*Cydia pomonella*, L.] to arsenicals [*R.A.E.*, A, xvii, 365, etc.] was based on their ability to infest sprayed fruit. In the experiments here discussed, the technique of which is described, larvae from Colorado and Missouri were fed on known amounts of arsenious oxide, some being given large doses to begin with and others gradually increasing doses. The resistance of the Missouri larvae proved at least as great as that of those from Colorado.

Stearns (L. A.) & Neiswander (R. B.). **Hydrated Lime in Summer Sprays for the Control of the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxii, no. 4, pp. 657–660, 1 pl., 4 refs. Geneva, N.Y., August 1929.

This is an account of experiments in the control of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) conducted in 1928, in which hydrated lime sprays were tested as a repellents to oviposition and as ovicides and larvicides. In 1927, injury by the larvae of the third generation on four young peach trees that had been severely infested by the previous generations was reduced by 81 per cent., by spraying with 40 lb. lime to 50 U.S. gals. water. The spray was applied four times at weekly intervals from 7th July to 4th August.

All sprays in 1928 were applied at a pressure of 300 lb. from a distance of six feet and for a period of eight seconds. In tests to determine the value of lime as a repellent, an average of 48 per cent. and a maximum of 84 per cent. fewer eggs were laid on foliage sprayed with 25 lb. to 50 U.S. gals. water, as compared with unsprayed foliage. Eggs sprayed with 15 lb. lime to 50 U.S. gals. water failed to hatch, partly owing to its desiccating qualities and partly to the thick covering it formed over the egg, thus preventing the larvae from breaking away from the shell. Owing to the continual cracking and scaling of the spray covering, 28 per cent. of the eggs sprayed with 25 lb. lime to 50 U.S. gals. water became detached, as compared with 2·5 per cent. that do so under normal conditions, and a spray of 15 lb. lime to 50 U.S. gals. in combination with other insecticides caused 71 per cent. more eggs to become detached than when the insecticides were used alone. Lime added to summer oil (2 per cent.) destroyed 94 per cent. of the eggs and 18·5 per cent. of the larvae that hatched from the eggs that remained. A spray of hydrated lime and 40 per cent. nicotine sulphate was unsatisfactory because this combination resulted in the nicotine being freed too soon. Some experiments in which lime was tested against the larvae have been previously noticed [*R.A.E.*, A, xvii, 388]. Injury to peaches by entry through the stem end was reduced by 69·5 per cent. by 20 lb. lime to 50 U.S. gals. water. The addition of various insecticides to the spray increased its efficiency; 58 per cent. reduction in twig injury was obtained with the addition of 10 lb. tobacco fish-oil soap, 65·5 per cent. with 3 lb. resin fish-oil soap, 63 per cent. with Volck (2 per cent.) and 77 per cent. with Volck (2 per cent.) and 40 per cent. nicotine sulphate, 1 : 800.

Harman (S. W.). **The Bud Moth in Western New York.**—*J. Econ. Ent.*, xxii, no. 4, pp. 660–662. Geneva, N.Y., August 1929.

Although usually a pest of minor importance in western New York, *Eucosma* (*Spilonota*) *ocellana*, Schiff. (eye-spotted bud moth) was more than usually abundant in 1927 and caused serious injury to apple in 1928. Probably the intensity of such an attack was partly due to spraying being replaced in some instances by dusting and the omission of lead arsenate and nicotine in early season applications. The overwintering larvae, on emerging in the spring, attacked the leaves, blooms and newly set fruit, and in some instances orchards were completely defoliated. Adults appeared late in June and were present in great numbers until the middle of August; 1,450 moths were dislodged from one tree by the application of nicotine dust. The

egg-hatching period lasted from the middle of July to September, and eggs were very numerous, as many as 10 being found on a single leaf. The nature of the damage both by the young and overwintered larvae is described; in some instances over 50 per cent. of the fruit was injured.

Thorough spraying of the lower surfaces of the leaves with lead arsenate reduced late summer injury from 35 to 7 per cent., but left an arsenical residue on the fruit. Great difficulty was experienced in coating the lower leaf-surface owing to the natural pubescence of the leaves. The larvae feed beneath this pubescence and under a silken shelter. The young larvae are susceptible to nicotine, and the addition of this material to summer sprays appears to be valuable. Large numbers of adults were caught in electric light traps and in bait traps. No appreciable control was exercised by parasites, of which *Trichogramma minutum*, Riley, was the most common.

GROSSMAN (E. F.). **Thermotropism of the Mexican Cotton Boll Weevil.** —*J. Econ. Ent.*, xxii, no. 4, pp. 662–665. Geneva, N.Y., August 1929.

A new apparatus for determining the thermotropic reaction of *Anthonomus grandis*, Boh. (cotton boll weevil) is described. It consists of 16 copper bars, the ends of which form a plane so arranged that the weevil placed on them must be in contact with at least two. The other ends of the bars are heated or chilled; they vary in length so that the temperature differs progressively. The average difference between two adjacent bars was 4° F.; the exact temperature of each bar can be ascertained by means of a thermocouple. Some differences were observed in the reaction of weevils ready for hibernation or removed from hibernation, and those captured in the field in August, and variations in light conditions also had some effect. The average temperature at which the weevils definitely reacted was 26° F. at the chilled end of the plane and 130° F. at the heated end.

FREEBORN (S. B.) & WYMORE (F. H.). **Attempts to protect Sweet Corn from Infestations of the Corn Ear Worm, *Heliothis obsoleta* (Fabr.).**—*J. Econ. Ent.*, xxii, no. 4, pp. 666–671. Geneva, N.Y., August 1929.

The effectiveness of a number of insecticides and repellents was tested in protecting maize against infestation by *Heliothis obsoleta*, F. (corn ear worm), and the best results were obtained from extra light sodium fluosilicate (70–75 per cent.) and a Japanese pyrethrum extract; ordinary black pepper proved to be a very satisfactory moth repellent when dusted on young ears. Poor results were obtained with arsenates and various nicotine combinations, including a new proprietary nicotine caseinate. The larvae have been observed to migrate from one ear to another before the ears have been completely consumed. The loose silk, which receives the coating of insecticide, is apparently not eaten by the larvae entering the ear, and it is therefore thought that fluosilicates kill by contact or impel a cleaning process on the part of the larvae passing through the dusted silk. The pyrethrum, like the pepper, was most effective on the young ears, but unlike the pepper, it was satisfactory in all stages, ranking next to the light fluosilicate even on ears in silk.

Whitcomb (W. D.). **Observations on the Carrot Rust Fly (*Psila rosae* Fab.) in Massachusetts.**—*J. Econ. Ent.*, xxii, no. 4, pp. 672–675. Geneva, N.Y., August 1929.

In Massachusetts, *Psila rosae*, F. (carrot rust fly) first became known as a pest in 1926, and in 1928 caused severe damage to carrots in the north-eastern part of the State. In addition to carrots, which are preferred, other Umbelliferae are attacked, including parsnips, parsley and celery. The nature of the damage is described; in celery and parsley the tunnels occasionally extend to the stems of the plants above the ground. Injury to carrots by immature larvae continues after the crop has been stored in autumn.

Hibernation occurs in the pupal stage in the soil, usually at a depth of about 6 inches or less, and emergence extends from 23rd May to 10th July, most of the flies appearing early in June. In lantern globes over potted carrots their average length of life was 4·3 days, with a maximum of 11. Oviposition begins about 4 days after emergence, the eggs being laid singly or in groups in cracks in the soil, under pebbles, or in crevices in the crown of the plant. In a few instances females laid as many as 20–25. The incubation period averaged 6·17 days. The feeding period of the larvae lasted on an average 27·55 days, and 52 per cent. of them left the carrots and entered the soil between 14th and 19th July. The last larvae of the first generation were found on 3rd August. The prepupal stage lasted 3 days, and the pupal stage 27. Emergence of the adults extended from 7th August to 4th September, 75 per cent. of them appearing between 8th and 19th August. They oviposit for preference near well-developed carrots. The larvae were observed entering the ground from 15th September till 28th October.

Attacks by the larvae of the first generation can be avoided by sowing the carrots about 10th June, approximately 3 weeks before the flies cease ovipositing. Of carrots grown under asphalt paper mulch 82 per cent. were free from injury by the first generation, the odour of the paper apparently acting as a repellent, but failing, however, to avert injury by the second generation. Late autumn ploughing and planting of crops as far as possible from areas previously infested are recommended. In the laboratory all flies confined with potted carrots that had been dusted with derris died in 24 hours. This insecticide was just as effective 3 days after the first application and also when diluted with gypsum, 1 : 1 and 1 : 3. Powdered derris applied in the field on 16th and 23rd June and 2nd July gave 87 per cent. control as compared with an untreated area, where 78 per cent. injury occurred. Derris-gypsum dust, derrisol spray, sodium fluosilicate spray and mercury bichloride solution gave 70 per cent. or more protection, but were not so effective against the second brood maggots when applied on 21st and 29th August under less favourable conditions.

Bourne (A. I.). **Spraying for the Control of Onion Thrips in Massachusetts.**—*J. Econ. Ent.*, xxii, no. 4, pp. 679–683, 1 pl. Geneva, N.Y., August 1929.

Much of the information on *Thrips tabaci*, Lind. (onion thrips) contained in this report has been previously noticed [*R.A.E.*, A, xiv, 489]. The application of sprays at a pressure of 150–175 lb.

instead of 125–150 lb. is recommended. A description of a sprayer propelled and operated by a motor capable of developing a pressure of 200 lb. is given. Biological studies of *T. tabaci* showed that the egg stage lasts on an average from five to six days and the larval stage about a week.

Glasgow (H.) & Cook (H. T.). **The Onion Maggot Situation in New York.**—*J. Econ. Ent.*, xxii, no. 4, pp. 683–688, 1 pl. Geneva, N.Y., August 1929.

Hylemyia antiqua, Mg. (*ceparum*, Mg.) is a serious pest of onions in New York State, and within recent years, owing probably to their more intensive cultivation, has been causing unusually severe damage. The onions are subject to attack for four or five months, as the flies from the overwintering puparia begin to appear in April, and the various broods overlap throughout most of the growing season. For control, a spray consisting of 2 per cent. red engine oil emulsion and Bordeaux mixture (4–4–50) applied by means of a motor sprayer at the rate of about 150 U.S. gals. to the acre and at a pressure of 20–30 lb. is recommended. Experiments with this spray are described and methods of applying it are discussed; 3 properly timed applications at weekly intervals usually give commercial control. As *H. antiqua* is normally only able to establish itself in young onions, early sprays are important, but it is not known whether they will afford sufficient protection throughout the season to the tender, thin-skinned varieties. Early spraying has also proved of considerable value in checking the development of weeds, while at the same time causing no serious permanent injury to the seedling onions. Sprayed onions keep better in storage in view of the elimination of maggot-infested ones, which soon decay and serve as centres of infection.

Parker (H. L.), Vance (A. M.), Smith (H. D.) & Gamkrelidze (W.). *Pyrausta nubilalis* **Hubn. in Europe: Notes on Infestation and Parasitism from 1926 to 1928.**—*J. Econ. Ent.*, xxii, no. 4, pp. 688–693, 1 ref. Geneva, N.Y., August 1929.

This paper is supplementary to one previously noticed [*R.A.E.*, A, xvi, 528]. Tables are given showing the percentages of infestation of maize and *Artemisia* by *Pyrausta nubilalis*, Hb. (European corn borer) and of attacks by its various parasites in different parts of Europe from 1926 to 1928. No striking change in infestation of maize or *Artemisia* was observed. A new species of *Holocremna* has been reared from larvae taken near Lille. Two parasites previously determined as *Phaeogenes planifrons*, Wesm., and *Macrocentrus abdominalis*, F., have been identified as *P. nigridens*, Wesm. and *M. gifuensis*, Ashm., respectively, and the Tachinid, *Exorista mitis*, Mg., is referred by Aldrich to the genus *Zenillia*. The species of *Chelonus* parasitic on *P. nubilalis* is identified as *Chelonus inanitus*, L.; in one locality in Italy it parasitised 3·2 per cent. of the first generation in 1928. Two primary parasites identified by Cushman as *Campoplex* [*Omorgus*] *lugubrinus*, Hlgn., and *C.* [*O.*] *rothi*, Hlgn., and by Ferrière as *Angitia armillata*, Grav., and *O. ensator*, Grav., have been exported from France to the United States. Other parasites recorded in various parts of France are *Apanteles thompsoni*, Lyle, *Macrocentrus gifuensis*, *Lydella* (*Masicera*) *senilis*, Mg., and *Microgaster tibialis*, Nees. *Angitia*

(*Dioctes*) *punctoria*, Rom., was found in small numbers on *Artemisia* in France and Italy. Among larvae of *P. nubilalis* collected in the forest and steppe region of the Dnieper River in Russia, parasitism amounted to 46·7 per cent., the species concerned being *Lydella senilis* (8·8 per cent.), *Microgaster tibialis* (1·3), *Eulimneria alkae*, Ell. & Sacht. (*crassifemur*, auct.) (1·3), *Angitia punctoria* (5), *Macrocentrus gifuensis* (24) and a Braconid, probably *Apanteles thompsoni* (6·3). A parasitism of 24 per cent. in 1927 and 30·7 per cent. in 1928 by *Zenillia roscanae*, B. & B., was observed in Dalmatia. Hyperparasites reported included *Eupelmus urozonus*, Dalm., from *A. punctoria* in the Mediterranean zone, and *Habrocytus* sp. from *L. senilis*, *A. punctoria* and *Microbracon brevicornis*, Wesm., in the neighbourhood of Bergamo, Italy.

Robinson (R. H.). **Facilitating the Removal of the Spray Residue.**—*J. Econ. Ent.*, xxii, no. 4, pp. 693–698. Geneva, N.Y., August 1929.

The effective removal of arsenical residue from fruit by washing in dilute hydrochloric acid may be prevented by the secretion of wax on the fruit, the presence of oil spray, excessive deposits of large spots of residue following abnormally heavy spraying, and dust that accumulates in the stem and calyx ends of the fruit. Washing the fruit three times did not reduce the residue below ·01 grain arsenic where dust coated the spray residue. Experiments were therefore conducted with sprays of lead arsenate in combination with various chemicals that might facilitate the release of the residue. Two or three applications of the spray mixtures were made, each being allowed to dry before the next was applied. The fruit was stored for seven days and then washed for one minute in 0·5 per cent. hydrochloric acid at 22° C. [71·6° F.]. Some of the materials proved very beneficial in aiding the removal of arsenical residue, the best being Bordeaux mixture, calcium carbonate and calcium hydrate. The chemical and mechanical reactions involved are discussed; in general it would appear that any material that is relatively insoluble in water but highly soluble in dilute hydrochloric acid would facilitate the removal of the residue. In further experiments, in order to make conditions resemble those produced by dust in the orchard, celite, a fine silicious material, was sprayed on the fruit after the first application of lead arsenate. In subsequent applications it was mixed with the latter. The dust caused about double the amount of arsenic to remain on the fruit when it was washed in 0·5 per cent. hydrochloric acid, but as before, the addition of Bordeaux mixture, calcium carbonate or calcium hydrate to the spray greatly aided the removal of the residue. For practical use the addition of 1–2 lb. hydrated lime to 100 U.S. gals. lead arsenate spray is recommended. Tables are given showing the results obtained in both series of experiments.

Patch (E. M.). **The Apple Aphid and the Citrus Aphid : *Aphis pomi* Degeer and *A. spiraecola* Patch.**—*J. Econ. Ent.*, xxii, no. 4, pp. 698–699, 1 ref. Geneva, N.Y., August 1929.

In view of the fact that *Aphis pomi*, DeG. (green apple aphis) and *A. spiraecola*, Patch (citrus aphis) are usually treated as distinct, the author indicates to which of these two species or races the records of food-plants in a bulletin previously noticed refer [*R.A.E.*, A, xii, 417].

ROARK (R. C.). **United States Insecticide Statistics for 1928.**—*J. Econ. Ent.*, xxii, no. 4, pp. 699–701. Geneva, N.Y., August 1929.

Statistics are given of quantities of various insecticides produced in, imported into or exported from the United States in 1926–28.

SAALAS (U.). **A short Review of economic Entomology in Finland.**—*J. Econ. Ent.*, xxii, no. 4, pp. 701–704, 1 ref. Geneva, N.Y., August 1929.

An account is given of the organisation and development of entomological experiment stations and laboratories in Finland. The literature on and legislation regarding pests are discussed, and a list of some of the injurious insects occurring in the country is given.

COCKERELL (T. D. A.). **The Westward Spread of** *Samia cecropia* **(L.).**—*J. Econ. Ent.*, xxii, no. 4, p. 704. Geneva, N.Y., August 1929.

Samia cecropia, L., has gradually been spreading westwards and has recently been found in several localities in Colorado where only *S. gloveri*, Strecker, occurred previously.

FELT (E. P.). **Mexican Bean Beetle,** *Epilachna corrupta* **Muls.**—*J. Econ. Ent.*, xxii, no. 4, p. 705. Geneva, N.Y., August 1929.

Epilachna corrupta, Muls. (Mexican bean beetle) was found to occur in places over a fairly large area in south-eastern New York and western Connecticut in July 1929. In many cases the injury to beans was limited to only a few plants or groups of plants, and the infestation was apparently of very recent origin.

SMITH (L. M.). **A new Material used to cage Insects on their Host Plants.**—*J. Econ. Ent.*, xxii, no. 4, p. 705. Geneva, N.Y., August 1929.

A cage made from a transparent cellulose paper and used for studying the biology of *Hyalopterus arundinis*, F. (mealy plum aphis) is described. As this material is permeable by atmospheric moisture, the condensation that usually occurs on glass is eliminated ; it is stated by the manufacturers to permit the passing of ultra-violet rays. It may, however, become soft and pliable and collapse on to the plant in heavy rain, or may crack in a strong wind during very dry weather.

FELT (E. P.). **Norway Maple Leaf Stalk Borer,** *Nepticula sericopeza* **Zeller.**—*J. Econ. Ent.*, xxii, no. 4, p. 706. Geneva, N.Y., August 1929.

Nepticula sericopeza, Zell. (Norway maple leaf-stalk borer) has become established in Connecticut in one locality, and trees have been infested in two localities in New York. The nature of the damage is described. Practically only the basal half inch of the leaf-stalk is mined. This Tineid may cause as much as 10 per cent. of the leaves to fall in June, and it has possibly been responsible for heavy leaf falls considered to have been due to dry weather or Aphids. It has been recorded as mining young fruit of *Acer* in Europe.

LaForge (F. B.). **The Preparation of some Pyrrolidine Derivatives. The Preparation and Properties of some new Derivatives of Pyridine.** —*J. Amer. Chem. Soc.*, l, pp. 2471–2477, 2477–2483. Easton, Pa., 5th September 1928.

The author describes the preparation of some pyrrolidine and pyridine derivatives chemically related to nicotine, but states that in tests of their possibilities as contact insecticides, none was found to possess toxic properties approaching those of nicotine. On the other hand, three known compounds derived from nicotine itself, namely, metanicotine, nicotyrin and dihydrometanicotine, proved of a high order of toxicity, the first-named being only slightly below that of nicotine.

LaForge (F. B.). **The Preparation of Alpha-, Beta- and Gamma-Benzylpyridines.**—*J. Amer. Chem. Soc.*, l, pp. 2484–2487. Easton, Pa., 5th September 1928.

In view of the discovery that benzylpyridines possess unusual insecticidal properties [*R.A.E.*, A, xv, 369], the author has devised somewhat new and more convenient processes for the preparation of these compounds, which might easily be developed on commercial lines should their practical value as insecticides become established.

LaForge (F. B.) & Smith (L. E.). **Rotenone. I. Reduction Products of Rotenone.**—*J. Amer. Chem. Soc.*, li, pp. 2574–2581. Easton, Pa., 7th August 1929.

The preparation and properties of some derivatives of rotenone, the insecticidal principle of the root of *Derris elliptica*, are described.

Nelson (O. A.). **Vapor Pressures of Fumigants. I.—Methyl, Ethyl, Isopropyl and Secondary Butyl Chloroacetates. II.—Methyl, Ethyl, *n*-Propyl, Isopropyl, *n*-Butyl, Secondary Butyl and Isobutyl Formates.**—*Indust. Engng. Chem.*, xx, no. 12, pp. 1380–1382 (reprints 7 pp.), 4 figs. Easton, Pa., December 1928.

In view of the prospective use of these compounds as practical fumigants, it was thought desirable to determine some of their physical constants. The methods and results of vapour pressure determinations are given in these papers.

Young (H. D.) & Nelson (O. A.). **Vapor Pressures of Fumigants. IV.—Vapor Pressure of Nicotine.**—*Indust. Engng. Chem.*, xxi, p. 321 (reprint 4 pp.). Easton, Pa., April 1929.

As nicotine is one of the most widely used and most effective fumigants against greenhouse insects, the vapour pressures of this compound at different temperatures are recorded and the methods of determining them are described.

Roark (R. C.). **Review of United States Patents relating to Pest Control.**—ii, nos. 1–6; 10, 15, 12, 14, 14, 14 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1929.

Abstracts of patents relating to insecticides, etc., issued from the beginning of January to the end of June 1929 are given.

Light (S. F.). **Termites and Termite Damage.**—*Circ. California Agric. Expt. Sta.*, no. 314, 28 pp., 25 figs., 6 refs. Berkeley, Cal., April 1929.

A somewhat popular account is given of the bionomics of termites, with particular reference to those known to occur in the Pacific Coast States. In controlling wood-dwelling termites in old structures, the source of infestation should be sought in dead portions of living trees, other buildings, fence posts, etc., in the neighbourhood, and eliminated. All infested timbers should be removed or burnt, or, if this is impossible, the introduction into the workings of Paris green by means of bellows or of orthodichlorobenzene is suggested. In the case of subterranean termites in old structures, timbers in or on the ground should be removed if possible and insulation effected, otherwise palliative measures, such as treating the timbers with creosote or sodium arsenite and the ground near them with sodium arsenite or other poisons, should be employed, though this may be ineffective in reaching the colonies.

With regard to preventive measures for new structures, all refuse wood, roots, etc., should be removed from the site, which should then be treated with some poison, such as a 5–10 per cent. aqueous solution of sodium arsenite, or with crude oil, the earth under and just inside the foundations being treated with particular thoroughness. All wood set in or on the ground should be thoroughly impregnated with coal-tar creosote to insure preservation wherever the expenditure is justified. Subterranean termites attack buildings by entering from the ground, and the most important preventive measure is to insulate the wooden structures of the building from the ground. All untreated wood, at least in Southern California, should be 24 inches or more above ground. Foundations that are otherwise impenetrable sometimes crack, and such cracks make especially favourable passages for ter mites from earth to wood. To obviate this, a continuous metal shield of heavy galvanised iron may be placed between the concrete foundation and the

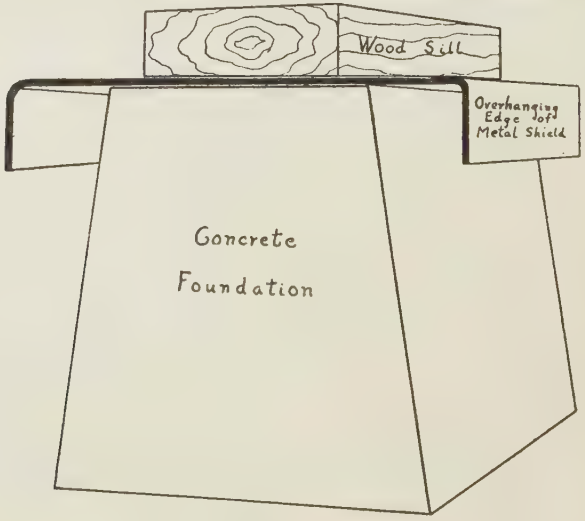


Fig. 1.

wood, with a projecting and overhanging edge to prevent the termites from building their covered ways over the foundation to the wood or at least to bring them out into the open if they do build over the projecting edge (fig. 1). Particular care should be taken in the case of

supporting pillars and porches to avoid the exposure of wood to contacts with the earth, especially those due to laying floors at varying levels. All pipes from ground to wood are potential pathways for entrance, and where practicable they should be coated with adhesive. Pipes running through concrete foundations should have a metal collar soldered to them and set in the concrete.

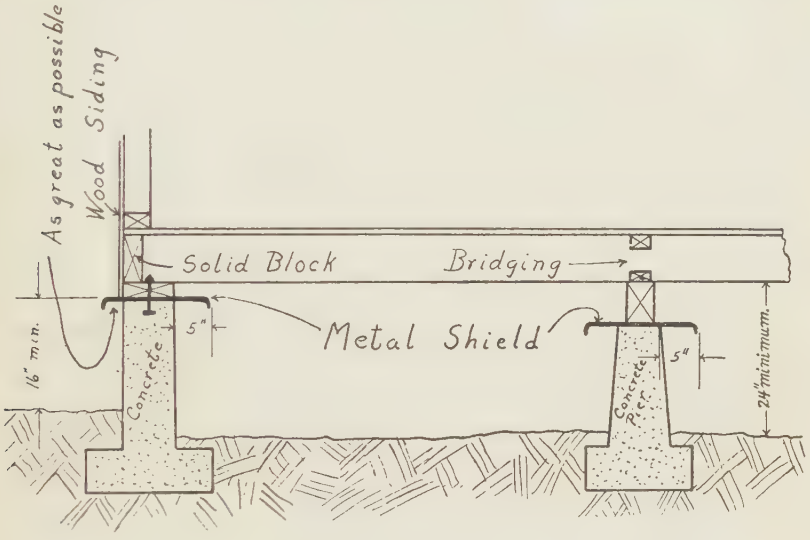


Fig. 2.

Plans (fig. 2) for proofing an ordinary house against subterranean termites are given, embodying the best methods known at the present time, and as stucco houses with enclosed wood seem to be particularly vulnerable to attack, a modification of the ordinary plans (fig. 3) is

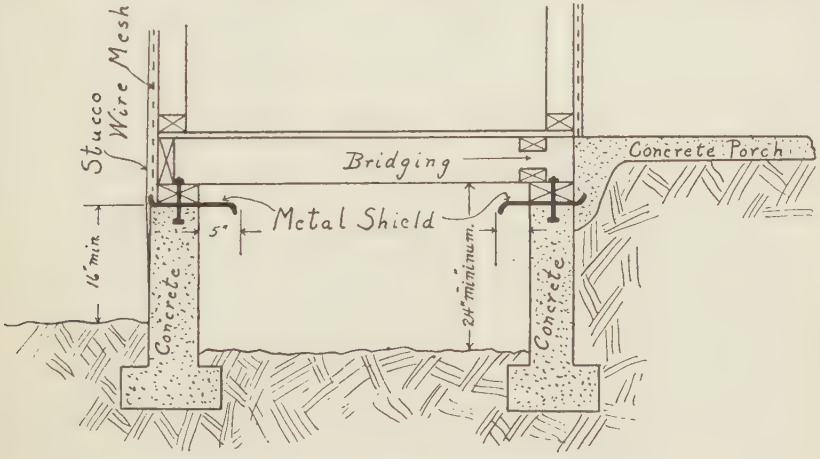


Fig. 3.

given with the suggestion that the stucco be discontinued at the foundation level, the colour effect being maintained by a colour wash on the concrete foundations.

Bruner (S. C.). **Reseña de las plagas del cafeto en Cuba.** [Survey of the Pests of Coffee in Cuba.]—*Circ. Estac. exp. agron.*, no. 68, 38 pp., 12 figs., 15 refs. Santiago de las Vegas, 1929.

Coccus viridis, Green, which seems to have been introduced during the past 15 years, is the Coccid most injurious to coffee in Cuba. Particulars of its biology in various parts of the world are given ; in Cuba a delay of about 11 hours occurs between oviposition and hatching of the eggs, whereas in Asia they hatch immediately. The chief natural factor controlling this scale in Cuba is the fungus, *Cephalosporium lecanii*. An oil emulsion containing about 5 per cent. kerosene is recommended against this and other Coccids. *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) is often associated with *C. viridis*, but is of less importance owing to its natural enemies, including *C. lecanii*, the Chalcids, *Eucomys* (*Encyrtus*) *infelix*, Embleton, *Coccophagus* sp. (? *saissetiae*, Gahan), *Gahaniella saissetiae*, Timb., *Eupelmus* sp., and *Calliceras* sp., and a Cecidomyiid, *Diadiplosis* sp. *S. oleae*, Bern., which was observed injuring coffee plants at the Experiment Station, is attacked by the Chalcids, *Lecaniobius cockerelli*, Ashm. (the most abundant species), *Plagiomerus cyaneus*, Ashm., *Aneristus ceroplastae*, How., and *Coccidoxenus portoricensis*, Cwfd. Other Coccids that have been observed in small numbers on coffee are *Ischnaspis longirostris*, Sign., *Howardia biclavis*, Comst., *Selenaspidus articulatus*, Morg., *Pseudococcus citri*, Risso, and *Pulvinaria psidii*, Mask. The Aleurodid, *Aleurocanthus woglumi*, Ashby, is not a pest of importance.

The injury caused by the Tineid leaf-miner, *Leucoptera coffeella*, Guér., does not exceed 5 per cent. of the crop. It is held in check by parasites, including the Chalcids, *Elachertus* sp. (the most common), *Horismenus cupreus*, Ashm., *Closterocerus cinctipennis*, Ashm., and *Zagrammosoma multilineatum*, Ashm. If necessary, the pupae can be destroyed by a nicotine spray. The adults of the Bostrychid, *Apate carmelita*, F., bore into the stems of living coffee and other plants, but oviposition and larval development only occur in dead ones. The injury caused is slight ; injections of carbon bisulphide may be employed. Pests of quite minor importance include *Toxoptera aurantii*, Boy., *Oeceticus poeyi*, Lucas, and *Atta insularis*, Guér., and, in stored coffee, *Araecerus fasciculatus*, DeG.

Boselli (F. B.). **Studii sugli Psyllidi. (Homoptera : Psyllidae o Chermidae.) iv. Biologia e sviluppo della** *Spanioza galii aspinovelutina* **(Sulc).** [Studies on Psyllids. iv. Biology and Development of *Trioza galii aspinovelutina*.]—*Boll. Lab. Zool. Portici*, xxiii, pp. 13–27, 8 figs., 5 refs. Portici, 18th September 1929.

Descriptions are given of all stages of *Trioza* (*Spanioza*) *galii* var. *aspinovelutina*, Sulc, of which the biology and food-plant were hitherto unknown. At Portici, *Rubia peregrina* [the roots of which yield a madder dye] was the only food-plant observed. The Psyllids hibernate and aestivate as larvae or nymphs in galls formed on the leaves, the adults developing in spring and autumn when the plant puts forth new shoots. Mating is soon followed by oviposition, the eggs being laid on the branches and tender leaves. After about 15–30 days, the larvae hatch and begin puncturing the lower surfaces of the leaves. The complete cycle takes 40–45 days, and in a favourable spring

three generations may occur. There is then an entire autumn-winter generation. This Psyllid is attacked by Chalcid parasites, and a thrips and mites were found in the galls, but these are possibly inquilines.

Miller (D.). **Control of Ragwort through Insects.**—*N.Z. J. Agric.*, xxxix, no. 1, pp. 9–17, 6 figs. Wellington, N.Z., July 1929. Also in *N.Z. J. Sci. Tech.*, xi, no. 2, pp. 112–119, 6 figs. Wellington, N.Z., August 1929.

It is hoped that the four weeds of major importance in New Zealand, namely, blackberry, ragwort, gorse and piripiri, may all be exterminated in time by means of the introduction of insect enemies. In three cases the work is still in its preliminary stages, but in the case of ragwort, field liberations of the cinnabar moth, *Tyria jacobaeae*, L., imported from England, have already been made. Preliminary tests were made to ensure that the moth would not attack any cultivated crop or plant of economic importance; its normal food-plants are groundsel and ragwort, and in its natural habitats it sometimes occurs in epidemic form, when it clears large areas; in these places, however, it is generally held in check by about ten different parasites. The only plant besides these accepted as food by the caterpillars in New Zealand was *Cineraria*. The pupae were sent over in cold storage, and distribution was made by means of eggs deposited on the leaves. The eggs are laid in clusters on the lower leaf surface, each female depositing about 150 under summer conditions, and hatch in about 8 days. The caterpillars feed for about 4 weeks, gregariously at first and then separately; both leaves and flowers are devoured, the latter being preferred. The mature larvae seek a sheltered spot among débris at the base of plants or in crevices, where they spin an imperfect cocoon and pupate, remaining throughout the winter in this stage. In Europe, *T. jacobaeae* has only one generation in a year, the adults appearing in spring; under New Zealand conditions it is hoped that two generations may develop. Some 500,000 eggs have already been distributed, and next spring further large distributions will take place. There are other insects in New Zealand that normally attack ragwort, but none of them is a permanent means of control. *Nyctemera annulata*, Boisd. (magpie moth), which rather resembles *T. jacobaeae*, is described; the eggs are laid on the lower leaf surface, and the winter is passed in the larval stage. This moth is abundant every year and periodically becomes epidemic, when it acts as a severe check to ragwort. There are two common parasites of this moth, namely, *Ecthromorpha intricatoria*, F., and *Lydella* (*Phorocera*) *casta*, Rond. *Homoeosoma farinaria*, Turn., and *H. vagella*, Zell., which bore in the stems of ragwort throughout the country, occasionally become epidemic, but are largely controlled by parasites. The larvae of a fly pith-borer, *Agromyza* sp., and of a leaf-miner, *Phytomyza* (*A.*) *affinis*, Mg., are often associated with ragwort, but do little if any damage to it. The two parasites of *N. annulata* have both been observed to attack *T. jacobaeae*, and a polyhedral disease destroyed many of the larvae in the insectary.

Taylor (T. H. C.). **The natural Control of the Coconut Scale.**—*Agric. J. Fiji*, ii, no. 2, pp. 43–45. Suva, 1929.

Since the importation into Fiji in 1928 of five species of Coccinellids from Trinidad to control the coconut scale, *Aspidiotus destructor*,

Sign. [*R.A.E.*, A, xvi, 632], there is abundant evidence that at least one species, *Cryptognatha nodiceps*, Mshl., has become well established. Observations in various localities in May 1929 show that wherever the predator has spread, the scale has been almost exterminated, and the condition of the trees is already greatly improved. The Coccinellid has evidently flown in some cases at least a mile in search of food, and has cleared up an infestation 10 miles from one point of liberation. Brief inspections on other Islands have indicated that equally satisfactory results can be expected on all of them. The beetle increases very rapidly, as the life-cycle requires about 3½ weeks, and a female lays about 120 eggs a month. Two of the other introduced Coccinellids seem to have become established, but are not an important factor in the control of the Coccid.

Papers noticed by Title only.

Paillot (A.). **La gattine et la flacherie vraie ou flacherie de Pasteur, maladies infectieuses mixtes à ultra-microbe et bactéries.** [The Etiology of Gattine and Flacherie in *Bombyx mori*, L.]—*C.R. Acad. Sci. Fr.*, clxxxix, no. 6, pp. 308–310, 1 ref. Paris, 1929.

von Winning (E.). **Stand der Kartoffelkäferfrage in Frankreich zu Beginn des Sommers 1929.** [Status of the Problem of the Potato Beetle (*Leptinotarsa decemlineata*, Say) in France at the Beginning of the Summer of 1929.]—*NachrBl. deuts. PflSchDienst*, ix, no. 9, pp. 75–79, 2 maps. Berlin, September 1929. [*Cf. R.A.E.*, A, xvii, 639.]

Chiaromonte (A.). **Nota preliminare su una nuova specie di** *Pseudantonina* **dannosa all'***Agave sisalana* **nella Colonia Eritrea.** [A preliminary Note on a new Species of *Pseudantonina* harmful to *A. sisalana* in Eritrea, *P. agaves*, sp. n.]—*Boll. Soc. ent. ital.*, lxi, no. 2, pp. 18–24, 2 pls., 1 ref. Genoa, 28th February 1929. [See *R.A.E.*, A, xvii, 352.]

Bellio (G.). **Note su Diaspinae dell'Estremo Oriente con descrizione di nuove specie (Homoptera : Coccidae).** [Notes on Far Eastern Diaspinae with Descriptions of new Species.]—*Boll. Lab. Zool. Portici*, xxii, pp. 219–243, 12 figs. Portici, 1929.

Horikawa (Y.). **Animals** [including numerous Insects] **used as Medicine in Formosa.** [*In Japanese.*]—*Dept. Hyg., Res. Inst. Formosa*, Contr. Extra No., 84 pp. Taihoku, 1929.

Pettit (R. H.). **Common Pests of Field and Garden Crops.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 183, 77 pp., 53 figs. East Lansing, Mich., June 1929. [Revision of previous Bulletin : *cf. R.A.E.*, A, xii, 493.]

Burgess (A. F.). **Die neuere Bekämpfung des Schwammspinners und Goldafters in Amerika.** A Review of Control Measures employed against the Gipsy and Brown-tail Moths (*Porthetria dispar*, L., and *Nygmia phaeorrhoea*, Don.) in Canada and the United States.] —*Anz. Schädlingsk.*, v, no. 7, pp. 77–80, 4 figs. Berlin, 1929. [*Cf. R.A.E.*, A, xvii, 554, etc.]

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* We are informed by Mr. F. Muir that the weevil recorded on p. 108 as *Rhabdocnemis lineaticollis* (which is also referred to under that name in a paper by W. D. Pierce, noticed on p. 109) is in fact *T. strangulatus.*—[Ed.]

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